DOCUMENT RESUME

ED 056 678 JC 710 252

AUTHOR	Pratt, Arden L.
TITLE	Environmental Education in the Community College.
INSTITUTION	American Association of Junior Colleges, Washington, D.C.
PUB DATE	71
NOTE	117p.
AVAILABLE FROM	American Associations of Junior Colleges, One Dupont Circle, N.W., Washington, D.C. 20036 ($4.00)
EDRS PRICE	MF-$0.65 HC-$6.58
DESCRIPTORS	*Ecology; *Environment; *Environmental Education; *Junior Colleges; Program Design; Program Development; *Subprofessionals; Technical Occupations

ABSTRACT

Environmental Education (EE) in community colleges and th e related role of students, administrators, educators, and potential employers is a growing national concern. Many of the questions related to each of these concerned groups are dealt with in this series of readings. They center around: (1) the nature and role of EE, (2) EE and the environmental technician, (3) the choice of curricula for EE and related occupational programs, and (4) the state of the art in EE and related technicaian training programs in community colleges. Three appendices give details for interested parties seeking to develop their own EE or technician training program. They are: (1) Occupational Curricula in Environmental Education, (2) The Modules of Man and Environment, and (3) Information Sources for Environmental Education. (AL)

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Environmental Education in the Community College

for

ARDEN L. PRATT

JC 710 252

UNIVERSITY OF CALIF.
LOS ANGELES

DEC 20 1971

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American Association of Junior Colleges
One Dupont Circle, N.W., Washington, D.C. 20036

Printed in U.S.A.

Acknowledgements

*I*ncluded in this monograph are papers solicited from Robert McCabe, J. N. Carsey and Carl Schwing (co-authors), and Edward Mackin. Also included is a paper by Noel McInnis, who granted permission for its use. Several references are made to a study conducted by The Center for Curriculum Design. Marilyn Colliver, Donna Magby, and Noel McInnis of the center prepared and collated this very useful information. The author's grateful appreciation is extended to each of the aforementioned individuals.

The funds to produce this publication were provided by the Danforth Foundation through the New Institutions Project of the American Association of Junior Colleges, and from the W. K. Kellogg Foundation through the Association's Occupational Education Project.

Arden L. Pratt
Director, New Institutions Project
American Association of Junior Colleges

Preface

In December 1970 at Pacific Grove, California, a varied group consisting of community college administrators, state department of education officials, professional writers, four-year college and university personnel, directors of state employment centers, mayors, administrators of skills centers, and federal government personnel from various departments, unanimously approved the following statement which they termed "The Asilomar Commitment."

This we believe:

That the community college must become the focal center of the community to encourage the coming together of all elements of the community . . . education, local government, industry, business, the disadvantaged, the handicapped, etc. . . . for the common purpose. In this way the community college can establish and foster a balanced program of ecological studies that can achieve the basic goal of community education and service.

That the community college is obligated to provide all groups with adaptive and generalized knowledge and technical training which provides a direction toward a human and humane environment.

That the community college is obligated to meet with local government and industry to both discover and create job opportunities that use this manpower resource.

Therefore, be it resolved that we pledge ourselves to translate this commitment into some immediate action which may include:

1. The initiation of a disciplinary environmental studies curriculum

2. The initiation of ad hoc committees
3. New MDTA proposals
4. Alternative funding mechanisms
5. Redirection of existing resources
6. New community organizations
7. Encouragement of open admissions and open college systems.

This was not the only time that community colleges had shown interest in environmental education (E.E.) and had taken a leadership role. However, for the first time, a diverse, national group was stating that environmental education must become an integral part of the commitment of the community college, along with a varied curriculum, an open-door, and community action.

This monograph includes discussions of general education courses, occupational education programs, community activities, and facilities planning.

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I

Environmental Education: Fad or Cultural Revolution?

The 1970 edition of the ERIC annual index contained almost fifty listings under "Environmental Education." The 1969 edition did not even include that heading. This, of course, does not mean that environmental education was not being taught prior to 1970; but what was taught was apparently not generally recognized as environmental education. In 1967, six occupational programs in environmental areas were identified by the U.S. Office of Education. This number has mushroomed to several hundred now offered or being planned. Appendix 1 contains a list of these programs.

Is environmental education a "fad," as some fear, or is it, as others view it, a "cultural revolution"? Some fear there may be a "backlash." What, they ask, will be the attitudes of those individuals who have lost jobs because of environmental and ecological concerns? Will the demagogic attitude of Harry Bridges, reflected in the following statement, become the general attitude of labor? "The ecology movement is obviously antiworker . . . it is a product of the ruling class."

What will be the continuing attitude of Congress and other branches of government at all levels? Will appropriations be made near the levels of funding authorized in legislation such as the Environmental Education Act of 1970? Or will the thrust be broken by lack of funding as it has been in so many pieces of educational legislation?

How effective will expenditures be? Will the money available for E.E. be expended in an orderly fashion? Or will the funds be wasted in what has been called "the tragedy of the commons"—that scramble

in which everyone tries to get his "fair share" through proposal writing and attempts to make the mundane look innovative?

How will students react when they are presented with problems which will not become critical for several decades, or even 100 years? Will they say, as too many of all ages before them have, "Let's enjoy ourselves today, and let those who come in the future handle it the best way they can"?

In current practice, environmental education is defined as broadly or as narrowly as each individual wishes. Some who have only recently introduced a program in an occupational field related to the environment say that it is the college's first try at environmental education. Yet those who have included a section dealing with ecology in a biology course or who have offered an occupational program in forestry technology feel that the environment and ecology have been among their major educational interests all along.

Certainly, special curricula are necessary to prepare students for particular occupations. Yet, environmental education can also include a broad longitudinal cut of a wide variety of types of education at all levels. Some of the major objectives of environmental studies can be met by specific course offerings covering limited topics such as ecology or population. Interdisciplinary or adisciplinary courses may be designed to induce or increase environmental awareness or general environmental knowledge. Community service programs can be offered to involve a wider population in environmental concerns. Curricula or courses designed for other purposes may include in their objectives a consideration of environmental awareness or may investigate the effect of the environment on these other fields. Awareness of the environment can be developed at the elementary, secondary, and postsecondary levels of education. Or it may be just as effectively considered outside of formal education.

Since the concerns of environmental education are quite diverse, definitions or descriptions have thus been offered by many sources. This has caused concern on the part of many. Edward A. Ames, program officer in the Office of Resources and Environment of the Ford Foundation, has said that assumptions on which much of our current environmental education are based are of questionable utility. We have not yet come to grips with the underlying basis of the environmental problems which face us.

Three viewpoints can be distilled from the diverse opinions that have been offered. One group would inject E.E. into all disciplines and course areas, either to broaden the course offerings or as an appendage or additional element of learning. A second group would use E.E. to inculcate an awareness of what is happening in the environment and the causes of these events. The third group would give individuals enough understanding of the environment that they could deal with problems by seeking specific alternatives or solutions.

The disagreement among educators over the meaning of E.E. and

the best way to teach it is, for the time being, a healthy situation. Still, complete indecision and indirection is not satisfactory. The public is growing impatient. Educators have said E.E. is of vital importance. The federal government has offered support. It is now up to the educational community to, at least, concentrate on a series of logical alternative approaches. Legislators and taxpayers have listened to enough "blue sky" programs and promises.

One of the most explicit definitions, which is at the same time almost global in its considerations, is included in the report issued by the U.S. Office of Education of the Department of Health, Education, and Welfare: *Environmental Education—Education that Cannot Wait* (a title derived from the First Annual Report of the Council on Environmental Quality, August 1970). The book includes a discussion of the foundations of environmental education and approaches to environmental education.

The following excerpt contains not only a definition and explanation of E.E. but also a philosophy and a specific point of view. Included is a discussion of the role of education in environmental improvement, an introductory discussion of programs and curricula, and the outline of an action plan designed for educators who would take full educational advantage of the "current public interest" in environmental education.

II

Environmental Education: Education that Cannot Wait

Today, man has the scientific and technological "know-how" to solve most if not all environmental problems. But decisions regarding man's use of his environment are seldom based on purely scientific knowledge. Virtually all human decisions are based on custom, oversight, economic feasibility, political expediency, social desirability, or religious belief. It has now become impossible to make wise decisions about the environment without an understanding of economics, history, political science, sociology, psychology, and the humanities, as well as the hard sciences. This calls for a new educational approach, environmental education, and this in turn needs to be defined.

The Environmental Educational Act of 1970, landmark legislation which reflects a national commitment to the search for enlightened life styles, has provided its own definition of environmental education. The language of the Senate report explaining the Act follows:

> *Environmental education is an integrated process which deals with man's interrelationship with his natural and man-made surroundings, including the relation of population growth, pollution, resource allocation and depletion, conservation technology, and urban and rural planning to the total human environment. Environmental education is a study of the factors influencing ecosystems, mental and physical growth, living and working*

Excerpts by the Environmental Education Studies Staff, Office of Education, U.S. Department of Health, Education, and Welfare.

conditions, decaying cities, and population pressures. Environmental education is intended to promote among citizens the awareness and understanding of the environment, our relationship to it, and the concern and responsible action necessary to assure our survival and to improve the quality of life.

As stated in the Act, and in Chapter 12 of the report of the President's Council on Environmental Quality, environmental education is a process which will affect the entire continuum of American education. It is a design for reform because it will, through every aspect of formal and nonformal education, improve philosophies of life and help each citizen to acquire a new and more viable life style.

This objective was first defined by people in local communities and has been given the highest national priority by the President and by the Congress. Survival as a culture and even as a species may depend on environmental education.

Aim of Environmental Education

Environmental education is a lifelong process. It is a way of looking at life, fostering awareness of other life and of interrelationships, learning to recognize the effects (good and bad) we have on physical surroundings, and the responsibilities we must accept for the mere fact of our presence and of our activities in our environment. It should enable us to make sound ecological decisions and foresee their consequences; to make value judgments and act accordingly. It is acceptance of life values and ways of living which minimize destruction and maximize those relationships that enhance life. It is learning how to contribute to the quality of life, and the constructive use, rather than exploitation, of the environment.

It is important to understand that E.E. is much more than a schoolhouse approach to ending the degradation of man-made surroundings and the pollution and destruction of the natural world. Environmental education will not simply provide an understanding of pollution problems and provide the nation with skills to meet or solve those problems. It is not merely a course in school or a curriculum combining elements of the natural and physical sciences into a new department or specialty. Nor is it just another name for outdoor education, resource management, or conservation education.

Environmental education provides alternate ways of thinking—a synthesis—which colors and affects the humanities, languages, social sciences, history, economics, and religion as dramatically as it does the natural sciences. It will give an ecological perspective for every aspect of learning.

Environmental Education Values and Principles

If environmental education is to be successful, the philosophies developed and the life styles encouraged must be predicated on values that are personally appealing and acceptable because they are them-

selves satisfactory, attractive, pleasant and desirable, and are harmonious with ecological principles.

Actions consistent with ecological principles include:

- Recognizing and accepting personal responsibility in decision making and stewardship toward the environment, and becoming increasingly aware and concerned about those aspects of ecology which directly come within the province of each individual. (This is in contrast to "I have my own problems" or "Let George do it" or "I'm just one person, what can I do?")
- Living in the environment with minimum disturbances to the rights and habitats of other living things, consistent with the health, safety, and certain basic comforts and pleasures of man as the dominant species. (This is in contrast to the thoughtless or willful destruction of living things, without regard for consequences, although hunting and fishing may be appropriate as long as they do not jeopardize the species.)
- Using only such resources as are required to maintain life in a balance of health and productivity permitting reproduction of the species at an optimum level, affording ample opportunity for growth of the mind and spirit, and encouraging artistic and creative expression. (This is in contrast to capricious use of resources and "conspicuous waste" in consumption beyond the manifest needs of the individual or group.)
- Making use of materials and energy in the most economic manner, balancing a supposedly desirable end against other possible ends. (This contrasts with seeking immediate pleasures rather than doing without in consideration of other benefits or long-term advantages. An example is insisting on quick and speedy "muscle" cars.)

These values would also include: health and safety in a pollution-free environment; privacy and quiet, with reasonable absence of persistent stress; quick, safe and pollution-free travel at moderate cost; good design in public works, reflecting freedom and openness and other human needs as well as utility and economy; employment in circumstances of dignity and with incentives; and reasonably comfortable standards of living, reflecting rewards for merit. Without question, many would also insist that living ecologically would also insure such values as reverence for life, peace, freedom from coercion and poverty, freedom in the expression of opinion and the right to learn, receiving and giving quality, value and service in business, dealing fairly and honestly in personal relationships, and having governments which are responsive and responsible to the electorate.

In summary, living consistently with ecological principles should protect and add to many important and acceptable human qualities or values.

Role of Education in Environmental Improvement

In pre-industrial times, the major role of education was to pass on the culture that had made the society cohesive and successful. Change was frowned upon, tradition held sway. In such societies, formal education was primarily for the young and for privileged classes that had time to explore new directions.

In post-industrial times, change gained the upper hand from tradition. New information necessary for success in society proceeded to accumulate rapidly. Education became necessary for more and more people. At first this increased education was based on new factual material, but as knowledge accumulated it has become increasingly necessary for the young to acquire the *process* of learning rather than transmission of tradition. Adults now must continually unlearn old facts, concepts, and skills and replace them with new ones.

In today's world, education has become a lifelong process. It proceeds both formally and informally through schools, private organizations, communications media, and continuing experiences. No serious or effective modification or improvement of attitudes and behavior of man towards his environment can occur without broad educational efforts at all levels of our society. People need to learn ways to perceive environmental problems and opportunities, to acquire the information for forming and evaluating alternative actions, and to develop the cultural skills for living according to chosen alternatives. All of this demands a high and continuing educational input. It is the only effective way to deal with the constant and rapid change in our current cultural environment.

Educational systems must provide the learner with the skills of continuous learning and a continuing flow of information about man and his environment.

Educational Expectations

Environmental education should begin with an understanding of the basic philosophy of education. Education is more than picking up a few useful tools during one's school years. The social and vocational skills provided by education are essential. Yet almost everyone would agree that education is much more. Education is progression, a growth of mind and spirit. Education is a process, the making of personal experience out of information. It is not something imposed from without. All real education is self-education.

The truly educated man perpetuates the childlike wonder with which he first encountered life. He is excited by exploration and discovery. He is fascinated with the difficult and mysterious, and is delighted with challenge. He matches his capacities with standards of excellence. He commits himself to quality.

Education is founded upon, deals with, and strengthens many moral characteristics of man. These include personal dedication to something of worth, patience in overcoming adversity and ignorance, courage in

facing the unknown and that which seems insurmountable, tolerance of others (including their ideas and life styles), and the humility to admit that after all is said and done one might be wrong.

Teachers are important, but not essential, in all aspects of education. Indeed it is often remarked that the long-term influence of an inspiring teacher is impossible to measure. On the other hand, teachers have an alarming and far reaching capacity to stifle everything which we believe constitutes education. For these reasons, teachers must themselves be well educated, show concern and even love for their students, and relate course material to everyday life problems. One of the objectives of environmental education is to increase the number of inspired and inspiring teachers.

It is to this broad philosophy of education that E.E. directs itself, for environmental and ecological studies concern both a way of learning and a way of living.

Programs of Environmental Education

Programs of environmental education will involve the entire American educational system, both formal and nonformal. A formal educational system in this context is one which is targeted on specific student-teacher relationships, through specific curricula. A nonformal system is less definitive and structured and is directed toward the public at large, or particular segments of the general public.

The formal education system, from preschool through continuing education, will directly affect about 50 per cent of the American population in this decade. Initially, the principal effort in environmental education should be that of developing supplementary materials that are designed for the traditional curricula such as English, biology, mathematics, and history. In addition, the development of new curricula applicable to nearly all teaching and learning situations should be initiated. The approach is to infuse environmental and ecological concepts into all studies which lend themselves to changing man's life style to one of harmony with his world.

Another approach for school systems might be that of developing a special environmental curriculum through which the traditional subjects would be learned. A third approach, but less desirable at the primary and secondary level, would be the creation of a new course called environmental studies.

The challenge for formal education is the establishment of curricula with relevant ecological content, presented so as to meet the present high motivation of students. This means that we must take advantage of all opportunities to relate learning experiences to actual environmental improvement and problem solving in the community (frequently referred to as "issue orientation").

The school must divorce itself from the traditional classroom concept and expand its frame of reference to make full use of all community resources in the curriculum. Environmental study areas, museums,

libraries, local businesses and industries, and local government agencies all have a role to play in formal education.

The school administrators and teachers should orchestrate these resources nto a workable curriculum, rather than concentrating on classroom materials. To accomplish this, it is imperative that a close working relationship (and frequent dialogue) be established among students, educators, businessmen, union leaders, and representatives of government at the local, state, and regional levels.

This will assist in formulating educational programs and activities that are relevant to real life issues . . . and give students the values, attitudes, and methods they will need to solve present and future problems deriving from pollution, increasing population, growing technology, resource depletion, and other environmental issues.

Nonformal* education will reach important segments of the general public (and in some cases the entire population of a locality) with environmental education programs. This will be a major responsibility of local and national media, volunteer agencies, business and industry, and other private organizations.

It is essential that both local and network television, radio, film studios, newspapers, magazines, and book publishers contribute increasingly to informing the public about critical environmental problems and their possible solutions. In addition, the vast advertising and promotional resources of business and industry may be directed toward environmental and ecological issues.

Many private and volunteer organizations look to school facilities and personnel—as well as to the children, their parents, youth, and others directly related to the educational activities of the schools—for full utilization of the programs and activities these organizations offer. Such programs presently include square dances, spring and winter festivals, musical and dramatic productions, nature hikes and bird walks, and similar activities. In addition, museums and libraries frequently arrange for special exhibits, films, or discussions of interest to general or special groups.

Increasingly, as part of a comprehensive effort in environmental education, these voluntary and private agencies may wish to orient their programs toward E.E. objectives and to plan them in cooperation with local schools and colleges capable of providing assistance and publicity.

It would be desirable for a national non-profit organization to accept as its primary task the creative role of encouraging, advising, and assisting private organizations and businesses to orient their considerable resources in nonformal education, information, promotion, and advertising toward E.E. objectives.

The emerging role of the local school system as participants in

* "Nonformal" is deemed more explicit than the commonly used adjective "informal."

nonformal education should be emphasized. Everyone can recall situations in his hometown and community where administrative staff and teachers of local schools have contributed their talents and services, as well as the school facilities, to worthwhile community projects such as curtailing drug abuse. A vastly broadened activity of this nature is called for if all the varied educational resources of any community are to be coordinated in a nonformal E.E. effort.

Nonformal environmental education, sparked by local schools, may include sponsorship of seminars, briefings for businessmen and community leaders, public forums and exhibits, informational programs and contributions to media, operation of centers for volunteer activities, and development of clearinghouses for environmental information.

Correlation is the key to full utilization of community resources, and the local school system may be the best or only public agency available to carry out the responsibility.

Training Programs: The need for trained personnel in all branches of environmental education is critical. This includes the training of educational personnel and environmental management technicians, as well as orienting other professions toward E.E. concepts.

Environmental education has emerged as the synthesis of widely diverse disciplines. For this reason, the development of educational personnel must recognize the opportunity and the unique circumstances surrounding the potentials for environmental education.

The present generation of educators faces a challenge in environmental education which is typical of this age. Frequently students are as concerned, committed, and knowledgeable as their teachers. Through TV and other media they may learn even faster than their teachers. This calls for a new learning-teaching style, a more informal instructional setting which is conducive to problem-solving approaches to learning, and, finally, extensive cooperation among all staff members of the school.

Teachers must be aware of environmental and ecological concepts and issues and should be given the opportunity to develop necessary skills through in-service training programs. They should also be involved directly in the development of environmental curricula. Teacher training programs must also be redesigned to prepare new teachers for the challenge and responsibility of E.E. To be effective in this new role the teacher must render support to and be supported from three areas:

- Administrators and supervisors must be attuned to the new strategies required in E.E. Well prepared teachers cannot work effectively if the system does not support them. This calls for a flexibility of response from the system and from individual administrators.
- The librarian must be prepared to keep the teacher informed of current as well as new and developing resources in E.E. This is

a necessary link between the individual school building and the local, state, and national network of dissemination.

- The paraprofessional can provide valuable support both as a direct link to the community and as an informed assistant in a variety of roles within E.E. Whether these individuals function as assistants in the library, in administration, in resources centers, or in the classroom, they must attain basic awareness of the broad goals and objectives of E.E. and of the significance of their task in the total program.

Manpower Training: The Administration has called for an expenditure of 10 billion dollars for the 1970's in the nation's battle against pollution. Most of these funds will go into construction and other forms of physical capital. If we are to utilize effectively these new facilities, we must make the decision now to invest in the training of people who will not only operate new plants but who are also capable of working effectively across the entire field of environmental management.

What is needed are carefully prepared short- and long-range plans that examine the manpower need in qualitative terms, as well as evaluate present and required sources of supply. There is no single agency with clear authority for developing environmental manpower at the federal level. Perhaps there shouldn't be. But there is certainly a need for coordination of the efforts in this critical field. Not to coordinate is to risk a serious duplication of efforts and resources, and we have too few resources to waste.

Another aspect of the environmental manpower problem concerns the experience, training, and educational requirements for employment in this rapidly emerging career field. Institutions are doing an excellent job of training young people for productive employment in many technical fields, but the emphasis is on specific problem solving and analysis in very narrow areas. This is precisely what must be avoided in preparing people for careers that require a broad environmental perspective. Introducing change in a successful but specialized system is a difficult but necessary task.

Educators must be prepared to search out and consider a number of alternative paths for developing this critical manpower. Therefore, research, evaluation, and focussing a national spotlight on new, inventive, and successful programs in the field of environmental manpower development will be emphasized by concerned administrators. A leading role is being played by community colleges in developing training programs of this type.

Environment and the Professions: An E.E. dimension is also a necessity for professional education. As the nation has begun to adopt environmental quality legislation, the legal profession is now faced with an immediate need for specialized programs in environmental law

in order to cope with the resulting litigation. Certainly, those in the medical professions, the engineers, the economists and the city planners will all need an understanding of the ecological principles that interface with their particular disciplines.

Since most professions have organized themselves into associations which hold conferences and exchange ideas in professional journals, the practicing professional can probably best be reached through his professional association.

Developing the curriculum base for the education of undergraduate and graduate degree candidates is, however, a much longer-range undertaking. Initial emphasis will be directed toward multidisciplinary change as well as the evolution of new undergraduate and graduate programs.

Environmental Encounters

Environmental education is basically encouraging and eliciting in children and others an awareness of environmental problems and ecological processes. It also fosters concern for the environment and for what is happening, and a growing sense of personal and group responsibility for the environment and for actions which affect the environment.

This may be accomplished through a series of environmental encounters, as devised by William B. Stapp of the University of Michigan, to link relevant ecological, economic, social, technological, and political factors. These encounters are meaningful environmental experiences that enhance existing instructional programs, particularly where ecological significance needs to be added to traditional subjects.

A program of environmental encounters, through both school and nonformal activities, leads to personal involvement with environmental problems or situations. This is the method of learning.

Environmental encounters also encourage respect for the environment and a personal commitment to improving quality of life. This may involve behavioral modification.

A simple and conventional encounter would be a study and work trip to a stream or other natural area. Another, and perhaps more cogent experience in environmental awareness, would involve people with different social and economic backgrounds.

Students who come from middle-class suburban homes could work as teaching assistants with younger children from socially and economically deprived inner city families. These children are frequently unfamiliar with ordinary things such as a "bookcase," or concepts such as a "circle." The students will begin to understand the problem as they develop and apply solutions.

Before the experience, the students will need brief instructions in technique. After the encounter, the students may discuss and report on the socio-ecological implications of the life style encountered.

As may be seen, an encounter is a personal experience with some

aspect of the environment in a situation of challenge and where some kind of decision must be made.

Young people are learning that the role of citizen calls for them to make decisions which affect their environment. They are most likely to make wise decisions in areas in which they have had prior experience in decision making, not merely knowledge. This includes voting, buying, resisting exploitative advertising, proper land use, and asking pertinent questions (as part of the process of holding businesses and politicians accountable).

Environmental Curricula

Entirely new curricula in environmental education need to be developed for all grade levels. This would normally be a five-year process, but the need is immediate. Early attention must therefore be given to providing teachers with materials which can be integrated into current curricula.

While this immediate need is being met in part, curriculum development must begin on a conceptual framework suitable for 20 years or more of environmental education. This work will build upon the experiences, innovations, and recommendations of many educators. Neither the Office of Education nor any single state agency will evolve such a total program apart from contributions of many agencies, local schools, and individuals.

Toward such a synthesis, and illustrative of the curricula and curriculum materials needed, some tentative priorities and objectives may be advanced.

Tentative priorities include:

- Provision of materials to be used with existing curricula for preschool, elementary, secondary, community college, and adult education levels.
- Development of materials to be used for nonformal adult education programs, including those of educational television.
- Curriculum development for the secondary level, and then for other levels according to need.
- Curriculum development for teacher training, including in-service training.

Tentative objectives may be considered for each of five educational levels, as follows:

- Preschool and elementary. At this age level, emphasis should be given to increasing the child's perceptual level through appreciation of space and form, the more evident relationships between man and nature, and a general appreciation of nature.
- Secondary. A more sophisticated understanding of ecological systems may be emphasized at this level, especially the relationship of man to his total environment. The student should also develop an increased awareness of the social, political, and eco-

nomic causes of environmental problems. He will also develop at this age an understanding of the various options for remedying problems, and the implications of these options for man.

- Undergraduate. Through multidisciplinary, problem-solving courses, college students should be able to relate the scientific, political, social, and economic aspects of environmental problems and to make value judgments leading to sound decisions. This will include a special emphasis on environmental/ecological concerns as they relate to traditional courses and disciplines such as history and literature.
- Graduate. Professional training through specific environmental/ecological courses, training in environmental quality control, and orientation to environmental/ecological concerns for professional students in medicine, law, public administration, etc.
- Adult education. Providing supplementary and refresher courses in environmental and ecological subjects, relating everyday-life situations to behavioral problems and decision making which affect the environment.

Administrative Response to Environmental Education

Educators need to assess the resources available and to set goals in environmental education. Judging from current public interest, there will be a popular response to E.E. Administrators may assume that they will receive support from the public in efforts to tie into national programs in environmental education.

To take full advantage of the unique opportunity offered by this general interest and support, it is essential that administrators begin by identifying the few who understand this complex subject and recruit them to assist others to comprehend the problems and the opportunities. Those who best understand the problems and opportunities are distributed throughout the country in elementary and secondary school systems, on college or university facilities, in foundations, in business and labor, and in numerous voluntary organizations. Therefore, educators should be encouraged to emphasize:

- Assessment of local educational resources in and out of the school system.
- Development of community/state/regional plans which will reflect the major needs of the regions.

To assist planning at the local level, the Office of Education recommends that early consideration be given to:

- Elementary and secondary education: supplementary materials, in-service teacher training curriculum development and demonstration projects.
- Preschool, middle school, and adult education: supplementary materials and teacher training.

- Public awareness (becoming more observant and sensitive to ecological problems, partly through reading, listening, and reviewing media materials on the environment), especially for 14 and above.
- Environmental manpower development (vocational and technical) at institutions of higher education awarding two-year degrees. Basic environmental education courses for college freshmen and sophomores.
- Introduction of environmental/ecological concepts to professionals (lawyers, engineers, city planners, etc.) who will need to relate to these ideas in continuing educational programs.

Additional areas of concern are in the development of educational personnel to reach professionals in need of environmental/ecological orientation; to develop an environmental/ecological consciousness in undergraduate and graduate students of the various professions; to assist in curriculum development and demonstration projects at the preschool, middle school, and adult level; to conduct programs of environmental awareness for preschool and elementary children; and to carry out retraining programs for environmental manpower technicians.

Several distinct approaches are currently being used to present the general education content of environmental education. Courses have been offered in community colleges for 15 years or more in areas such as ecology and conservation. Within the past two years there has been an increased concentration on the development of interdisciplinary courses in E.E. These are often presented as a series of lectures, each one covering a limited number of discipline-oriented topics. Topics may be presented by individuals from those disciplines or team taught. Sometimes they are presented by one faculty member using materials prepared in cooperation with faculty members from the other disciplines. However, this segmented approach is not truly interdisciplinary.

Recent efforts have been directed toward developing truly interdisciplinary courses. There are generally three points of view on how this should work. Some believe an interdisciplinary approach is best implemented by having people from various disciplines work separately, but in a coordinated way. Most of the interdisciplinary work of this type has taken place in the natural sciences.

A second group believes that an interdisciplinary approach is best accomplished by having people from various disciplines work cooperatively on a single project. (This is sometimes referred to as multidisciplinary.) This method appears to be the most difficult one to implement successfully, possibly because individuals who are discipline-oriented often are not experienced in working with people strongly oriented to another discipline.

The third general group believes that, to implement a true interdisciplinary approach, all people must work without regard to discipline. (This is, possibly, best termed adisciplinary.) However, very few effective people are available who have trained with no specific discipline background. Moreover, many reject this approach because they do not believe that an individual should talk, for example, about water pollution problems and solutions unless he is an expert in the field.

The first example of an interdisciplinary approach is a generalized approach to a total consideration of the environment. Noel McInnis discusses the Spaceship Earth Curriculum Project from Kendall College's Center for Curriculum Design. This project represents one institution's attempt to broaden environmental and ecological considerations which are presented to the student, and exemplifies many similar course developments now in progress. While the term "Spaceship Earth" is not exclusive with Dr. McInnis, it is certainly descriptive of the principal forms and objectives of the educational experiences attempted in the course.

III

Getting with Spaceship Earth

NOEL McINNIS, *Director*
The Center for Curriculum Design
Kendall College, Evanston, Illinois

We cannot effectively manage the environment without knowing what it is and how it behaves. We cannot detect changes, natural or man-made, desirable or undesirable, without repeated observations and established baselines. We neither know in a systematic way what the environment is like nor how and at what rate it is changing.[1]

Mankind is about to discover another planet. Until recently it was assumed that we had discovered all of the planets in our solar system, but it now turns out that this is not the case. In the process of scanning the skies for Mercury, Venus, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto, we overlooked the most important planet of all—Earth. Earth is the most important planet by any human definition, since this is the planet which sustains human life. And it is precisely because Earth is our home that we never discovered it before.

Men on earth are in the same predicament as fish in the water. "If you want to know about water," Marshall McLuhan has quipped *ad infinitum*, "don't ask a fish." The environment into which we are born remains invisible to us unless one of two things happens: (1) we leave it, or (2) it changes drastically. Quite recently, both of these things have happened to man-on-earth. Man left the earth long enough to look it over, and brought back pictures which make it difficult for us to overlook the planet as we had before. And those of us who stayed on earth discovered our planet by virtue of the fact that its feedback is doing things to us which were entirely unintended by our input. The coincidence of these events is quite literally leading to our belated discovery of the third planet from our sun. What we are discovering, of course, is that the planet as a whole behaves differently than its parts. Our present habits of relating to the planet only in part are producing a planetary reaction which, on the whole,

will be unfavorable to our continued enjoyment of the planet if not our very existence itself.

We are discovering, in other words, that our planet is a spaceship, *a closed, finite system in which all behaviors ultimately feed back through the system upon themselves.* Inappropriate behavior in one component of the system can disrupt or destroy the entire system. If the system is as complexly (and therefore as flexibly) regenerative as that of our planet, the destruction is more likely to be relative: the source of disruption will probably be eliminated by the system long before the system itself collapses. The system will become greatly altered in the process, but the whole will still survive the loss of some parts. Unlike the Apollo craft, as Bucky Fuller is fond of pointing out, the earth did not come equipped with an operating manual. Neither, therefore, does it require our services as crew. "Men go and come," we are told in *Ecclesiastes,* "but earth abides." It may also be written that man came and went.

On a spaceship, every sub-system is related to every other sub-system. Nothing in the design functions without reference to everything else. All sub-systems are affected by a major change in any one of them. In other words, the various sub-systems of a spaceship constitute one unified, balanced system. Any imbalance originating in one of the sub-systems is eventually redressed throughout the whole.

So well-integrated are our planet's numerous systems that the earth functions as a single organism. This fact we have demonstrated to ourselves most dramatically by the massive application of fertilizers and pesticides. The system-disruption potentials of this activity are most vividly illustrated by our long-term experience with DDT. DDT symbolizes our dread of an unavoidable function of the plant—death. Although DDT's effects are mild in comparison with many other chemicals used in our death-control tactics, it has become the focus of all those who see the folly of avoiding our death by annihilating other forms of life.

DDT is being metabolized by the entire planet. It is found in the fatty tissue of penguins at the South Pole, thousands of miles from its nearest application. DDT is found in the fatty tissue of creatures of the air, creatures of the mountain, creatures of the plains, and creatures of the mid-ocean. DDT is carried by all of the planet's transmission systems—air, water, and food chains. As a result, the planet is soaking up DDT like a sponge. When DDT begins, as it has, to take its toll of the oceanic vegetation which produces 70 per cent of the earth's atmospheric oxygen, it has begun to seriously affect mankind. Since we are at the top of the food chain, we humans stand to concentrate more DDT in our systems than any other species. The concentration of DDT in our species is already so great that the milk of nursing mothers, in this country at least, exceeds from 2-6 times the amount of DDT considered adequate to make milk unfit for

commercial sale (i.e., human consumption) in interstate commerce.

On a spaceship, all inappropriate behaviors ultimately feed back through the system upon themselves. When we cast our bread upon the waters, we can be sure of its eventual return.

"What Does Our Planet Do?"

We must frankly admit that the discovery of our planet may not come in time to save us. The prevailing crisis mentality could as easily increase the disruption of the planet's functioning as decrease it. This is because many of the remedies being proposed, frequently called "eco-tactics," are as partial and out of context as the short-sighted human activities that created the crisis to begin with. I am afraid that too many of us are approaching the environment crisis like James Thurber's "Scotty Who Knew Too Much." [2]

> *Several summers ago there was a Scotty who went to the country for a visit. He decided that all farm dogs were cowards, because they were afraid of a certain animal that had a white stripe down its back. "You are a pussy-cat and I can lick you," the Scotty said to the farm dog who lived in the house where the Scotty was visiting. "I can lick the little animal with the white stripe, too. Show him to me." "Don't you want to ask any questions about him?" said the farm dog. "Naw," said the Scotty. "You ask the questions."*
>
> *So the farm dog took the Scotty into the woods and showed him the white-striped animal and the Scotty closed in on him, growling and slashing. It was all over in a moment and the Scotty lay on his back. When he came to, the farm dog said, "What happened?" "He threw vitriol," said the Scotty, "but he never laid a glove on me."*
>
> *A few days later the farm dog told the Scotty there was another animal all the farm dogs were afraid of. "Lead me to him," said the Scotty. "I can lick anything that doesn't wear horseshoes." "Don't you want to ask any questions about him?" said the farm dog. "Naw," said the Scotty. "Just show me where he hangs out." So the farm dog led him to a place in the woods and pointed out the little animal when he came along. "A clown," said the Scotty, "a pushover," and he closed in, leading with his left and exhibiting some mighty fancy footwork. In less than a second the Scotty was flat on his back, and when he woke up the farm dog was pulling quills out of him. "What happened?" said the dog. "He pulled a knife on me," said the Scotty, "but at least I have learned how you fight out here in the country, and now I am going to beat you up." So he closed in on the farm dog, holding his nose with one front paw to ward off the vitriol and covering his eyes with the other front paw to keep out the knives. The Scotty couldn't see his opponent and he couldn't smell his opponent and he was so badly beaten*

that he had to be taken back to the city and put in a nursing home.

Moral: It is better to ask some of the questions than to know all the answers.

Until we have a fairly good answer to at least one question, all of our answers are likely to aggravate the problem. We cannot intelligently cope with our spaceship until we know what it does. The question *"What does our planet do?"* is the priority question of our time. Until we know what our planet does, we cannot establish an intelligent ecological relationship with it.

Getting with It

Ecology is, after all, the study of the transactions among the organisms in a given environment. In any given instance, therefore, it is first of all the study of the relationship of an organism with, not to, its environment. The distinction between relating with and relating to is difficult for the Western mind to grasp, since almost all of our environmental perceptions—human relationships as well as physical—are based on the law of the lever. We tend to perceive all of other-than-self as so much mass to be manipulated, as so many relationships to be had rather than transacted. As a result, our technologies are now succeeding in the manipulation of our total environment, with the further result that we are now "being had" by the planet.

The only way we can avoid "being had" by the planet is to get with it. But we cannot get with the planet until we know what it does. We are, therefore, desperately in need of intelligent eco-strategies to assure that our eco-tactics are healing rather than aggravating the situation.

Eco-strategy involves the monitoring of natural processes and the development of related technologies. Eco-tactics are attempts at environmental manipulation. Perhaps the best way to illustrate this distinction is to take a brief look at the problem of birth control. The pill and the intrauterine device represent a tactical approach to the problem of birth control. Both the pill and the IUD represent the manipulation of a system to alter its functioning; the pill and the IUD are something we do to the reproductive system. The rhythm method, on the other hand, represents a strategic approach to birth control. Although it has not been a highly reliable strategy, it could be. The body chemistry of the female during the time she is capable of conception is different than when she is not. What if a woman were capable of accurately monitoring this particular nuance of her body chemistry, via a reasonably simple test analagous to the litmus test or the simple urinalysis with which diabetics can monitor their sugar level? If she had this monitoring capability, it would not be necessary for her to tactically tamper with her physical processes or to tactically deny her emotional ones. She could very strategically "get with" her reproductive process and control birth in nature's own way.

We are every bit as much in need of getting with the planet as we are in need of getting with the human reproductive process. Population is a global problem, yet very few persons perceive it in global depth as well as in global breadth. The closed-system nature of our spaceship assures that any major change in the functioning of the human reproductive process, such as Zero Population Growth, will effect changes in many other systems. We cannot alter the pattern of human reproduction without altering the patterns of related systems. A most obvious example: we cannot establish equilibrium in the population if we insist that Gross National Product must continually rise. Equilibrium in one major system requires equilibrium in all major systems. The assumption of additive growth, if ruled out for the population, must also be ruled out for the economic system. The economic implications of Zero Population Growth are in direct conflict with the economic assumptions which presently govern this country. Zero Population Growth is more subversive to the "American way of life" than Communism, because even Communism shares with capitalism the goal of additive growth.

The fact that man is not presently with the planet is dramatically illustrated if we imagine that we could compress the world's present population of over three billion persons into one town of 1,000 persons, in exactly the same proportions.[3] In such a town of 1,000 persons there would be only 70 Americans. These 70 Americans, a mere 7 per cent of the town's population, would receive half of the town's income. This would be the direct result of their monopolizing over half of the town's available material resources. Correspondingly, the 70 Americans would have fifteen times as many possessions per person as the remainder of the townsmen.

The 7 per cent American population would produce 16 per cent of the town's food supply, eating nearly twice as much as necessary and storing for their future use, at tremendous cost, most of what they were unable to immediately consume. Most of the other 930 inhabitants of the town would be hungry, and undoubtedly there would be hard feelings.

The 70 Americans would have an average life expectancy of 70 years, the other 930 less than 40 years. The lowest income group among the Americans, even though it included a few people who were hungry much of the time, would be better off by far than the average of the other townsmen. The 70 Americans and about 200 others representing Western Europe, and a few classes in South America, South Africa, Australia, and Japan, would be well off by comparison with the rest.

Could such a town, in which the 930 non-Americans were quite aware of both the fact and means of the Americans' advantages, survive? Could the 70 Americans continue to extract the majority of the raw materials essential to their standard of living from the property of the other 930 inhabitants? While doing so, could they convince

the other 930 inhabitants to limit their population growth on the thesis that resources are limited? How many of the 70 Americans would have to become soldiers? How much of their material and human resources would have to be devoted to military efforts in order to keep the rest of the town at its present disadvantage?

Chances are the 70 Americans would have to organize into a military camp in order to maintain their material dominance of the remainder of the town. Probably most of the Americans would be too insecure or guilty about their situation to enjoy their dominance. This guilt and insecurity would lead some of the Americans to protest the situation and call for a change. But probably the protesting Americans would find themselves subjected to variations of the same repressive forces being used to subdue the other 930 townspeople. Chances are the military camp would also be a police camp.

The most regretful thing about this situation is that it is not imaginary. For such is the present material relationship and incipient political relationship of the United States to the rest of the world. The material relationship is very clear: the United States is systematically plundering the planet's physical resources. And if the political conclusions drawn above are not yet so, they are rapidly becoming so. The logical complement of a nation of plunderers is a nation of police.

Environmental Monitoring

The only way to get with the planet is to find out what it does through a world-wide system of environmental monitoring. A recent report of the National Academy of Sciences makes it clear that such monitoring is a necessity not only for coping with global problems, but for dealing with localized problems as well:

> *The necessity for very broad monitoring is suggested by consideration of a relatively simple environmental relationship. Many people have settled in Southern California to enjoy the sun at the broad, clean beaches. Houses have been built right at the edge of the beach, which in some places have then become littered with kelp and buzzing with flies. The houses have displaced tiny animals such as isopods, which previously ate the kelp. More houses have been built inland and in some areas have been subject to floods. Dams have been built and have stopped not only flood waters but also the sand that replaced the beach sand being constantly lost to deep water. Thus the beaches are becoming less wide and less widespread. Finally, to get to the beaches, more and more people drive more and more automobiles, and the resulting smog obscures the sun.*
>
> *This is a very simple outline of a most complex relationship. We cannot say what happened. We shall have no more success than we have had so far in dealing with these problems in the future without a comprehensive plan for monitoring the whole*

environment and its changes and knowing the possible consequences.[4]

The *whole* environment of any locality is, of course, nothing less than the entire planet. Nothing less than an understanding of the entire planet as an integrated system is becoming an absolute requirement for intelligent human interaction with local environments.

The problem with environmental monitoring today is not that there is none, but that existing programs are partial and uncorrelated:

> *We do make some baseline and serial observations at present through such environment-related agencies as the Environmental Science Services Administration, the U.S. Geological Survey, the Bureau of Commercial Fisheries, the Bureau of Sport Fisheries and Wildlife, the Forest Service, the National Air Pollution Control Administration, and the Federal Water Pollution Control Administration. In addition, many local and state agencies secure data on environmental parameters. Most of these data are obtained for special purposes, there is little cross-referencing of data, few comparative studies, and no overall evaluation of the quality of the environment. The existing environmental monitoring program has many critical gaps.*[5]

Fortunately, we can get with the planet. We know enough about what the planet does that we are now able to develop the means for finding out everything else we need to know in answer to that question. The relevant information is being gathered by numerous national and international agencies, as well as by corporate and educational research departments. But it remains uncorrelated and uncommunicated. It is not being disseminated through the schools. As a result, the people who are least informed about our planet are those who are being prepared to live on it.

Thinking the World Together

The reason we learn very little about the planet in our schooling is because of the curriculum's overwhelming concern with the affairs of men. As far as the curriculum is concerned, man is the planet, and thus it is that we learn to consider only the human inhabitants of our spaceship as having first-order significance. When we do study the planet, it is still only a partial endeavor. We learn about the geographical part, or the biological part, or the physical part, but never are we enabled to develop a sense of the whole thing. We are never presented with a perception of the planet as the total system that it is, so that we can perceive all of its parts in context. While the mind may be unable to concentrate on the planet as a total system, it can certainly develop a planetary perspective or world-view which enables it to concentrate on particular sub-systems *in contemplation of the whole.*

Unfortunately, geography is largely the study of the names man

has given to various locations on the earth and what he does with these locations. Biology is largely the study of terms man has given to the biota. Physics is largely the study of mathematical formulations man has given to discovered functions of the planet. And so on. Our formal studies of the planet, particularly at the level the vast majority of us encounter them in school, are focussed upon the symbols we use to identify it rather than upon that to which the symbols refer.

Our present curriculum has enabled us to master our ability to think the world to pieces. Since we can relate to our environment only in the terms that we perceive it, we are now quite effectively tearing the planet to pieces. If we are to think the world together, to comprehend (com - together; prehend - take) it as a single piece, we must create a new curriculum to complement the old.

The old curriculum has been very successful in conveying to us the fragmented, analytical, mechanical world view which enabled man to develop a technological civilization and which now shapes us to behave in mechanical conformity with our creations. But the planet and its occupants do not function according to the technological program with which we are attempting to subdue it, and thus our behavior is on a collision course with our own being. The planet's "program" is preponderantly that of synthesizing parts into wholes. Man's program is preponderantly that of reducing wholes into parts. If the latter program is merely preliminary to a synthesis which accommodates itself with the planet it is all right. But if man continues his program of reducing wholes into parts as he is presently doing, his will be the ultimate parting from the planet.

We are desperately in need of perceiving the planet as a *gestalt*. The world ultimately must hang together in our perception of it, if we are to hang with it. There is no institution which does more to shape/misshape our perception of the world than the schools. A major burden for the creation of a planetary world view therefore rests upon them. At present, any student who emerges from high school or college with some sense of how the world works does so in spite of his formal education. Present and subsequent generations must obtain such a perception as an integral part of their education; somewhere they must learn to think of the world together.

The need to think the world together is increasingly recognized by numerous individuals and organizations, and a few isolated and partial attempts are being made to develop educational materials and strategies to meet this need. Although none of these attempts is as fully developed as some of the isolated and partial environmental monitoring programs mentioned above, they would certainly derive a similar advantage from any concerted effort at correlation. At a minimum, they would benefit from the mutual awareness of one another's concerns, ideas, and objectives.

Some time ago it was announced that the missing link between ape man and civilized man had been discovered. It turned out to be our-

selves. This announcement was probably inaccurate in perspective. We *have* achieved the main fruits of civilization—and are discovering that many of them are too bitter to be tolerated. We have to get beyond civilization. The announcement should read that "the missing link between ape man and earth man has just been discovered. It turns out to be ourselves."

So we'd better get with it.

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1. *Institutions for Effective Management of the Environment.* National Academy of Sciences, Washington, D.C., January 1970, p. 37.
2. Copr. © 1940 James Thurber. Copr. © 1968 Helen Thurber. From *Fables for Our Time,* published by Harper and Row. Originally printed in *The New Yorker.*
3. This analogy is quoted from Richard Heiss and Noel R. McInnis, *Can Man Care for the Earth?,* to be published in Spring 1971 by Abingdon Press (Nashville).
4. *Institutions . . . ,* pp. 38-39.
5. *Ibid.,* p. 37.

The Spaceship Earth concept is a unified approach to Environmental Education, generally depending on the total eco-system as a frame of reference from which considerations will be made. Many educators believe this to be a "positive" approach which will stimulate students' creativity.

A second popular approach is to offer a distillation of theory and practice of conservation and management of natural resources and their relation to the total environment. The total environment usually includes: physical-air, oceans and fresh water, soil and minerals; biological-wildlife, forests, grasslands, and watersheds; participant and spectator sports like swimming, fishing, boating and sailing.

A third approach, and probably the most widely used, is the basis of the following paper by Robert McCabe. Dr. McCabe discusses a year-long adisciplinary course developed through the cooperation of a number of community and junior colleges. The course deals with environmental problems and man. In many cases, the creation and development of modules were done by individuals not directly in a related discipline.

Once again, the title is not original with the group developing the course. A course with the name "Man and Environment" is offered in many community and junior colleges. However, much of the material contained in the year-long course and the approaches used are distinctive and the cooperative method of course development, described by Dr. McCabe, was quite unique.

IV

Man and Environment: A General Education Course

ROBERT H. McCABE, *Executive Vice President,*
Miami-Dade Junior College, Miami, Florida

In recent years, Americans have begun to hear dire forecasts of disaster concerning the future of the planet upon which we live. Every day our newspapers report serious problems and continued deterioration in our life-supporting environment. Until very recently, admonitions that man must change his ways if he is to survive have been passed off as crackpot ideas or scare tactics employed by persons with special interests. However, the public is now becoming increasingly aware of mounting evidence that man is systematically destroying the environment on which his very life depends.

The problems of the environment run the gamut from those created by interpersonal tensions to problems in our water and air. However, certain of the most visible problems—for example those of water or air pollution—have drawn the most concern from the public. As instances of this, Miami has had a haze lying over the western suburbs and frequent fog, both for the first time; the Los Angeles city schools have canceled physical education classes on certain days because the very breathing of the air about one is harmful, and the extra exertion means pulling in additional air; the air in New York City has been considered dangerous more often than satisfactory; major cities throughout the country have begun to establish centers to which people suffering from respiratory disease can go when air pollution warnings are in effect; and rain in Gary, Indiana, was once analyzed as a mild solution of sulfuric acid. In view of these events it has become impossible to avoid concern over air and air pollution.

An awareness of water pollution problems seems to be almost equally prevalent. When we read of a red tide killing millions of fish in California and the declaration that Lake Erie is dead (meaning it can no longer support higher life forms); when people crossing the Atlantic Ocean begin to see floating sewage; and when a diver in the Newark Harbor can't find a sunken ship because of the thickness of the "water," the problems of water pollution are overwhelmingly apparent.

However serious the problems of air and water pollution seem, and they are serious, they represent only a minor part of the whole picture concerning the deterioration of our environment. Perhaps more important than the immediate impact of pollution is the realization that we can, in fact, run out of an adequate supply of air or water.

Population and the Environment

Central to all of the problems of our environment is an ever-increasing population. Should it increase at its present rate, we will reach a level beyond the support capacity of this planet within a relatively short number of years (some say this could happen as early as the year 2035). The consumer and growth orientations of Western civilization increase the impact of each new individual on the environment, and exacerbate the impact of population increases.

Urban areas of our country and the world have become increasingly hostile environments for man. The conditions that have evolved in New York City exemplify the plight of urban areas. Recently during a tie-up of services by police, waste collectors, and transportation workers, a comedian on one of the night talk shows said that Mayor Lindsay was requesting that criminals refrain from committing any crimes unless they were urgent or necessary during the present crisis.

In a humorous way, this expresses the sense of frustration and powerlessness to deal with an environment that is increasingly a part of everyday life in many metropolitan areas. Power failures or brownouts and blackouts have become almost an expected part of urban life. The breakdown in services is lived with and considered normal. Increasingly, governmental officials with responsibilities for urban areas are indicating their feeling that the problems cannot be effectively resolved. It has been said, jokingly, that the only way to solve New York City's problems is to export several million people. But perhaps that really is the only solution for a number of urban areas.

Most important is the question of where such people could be exported. With the increasing population and the increasing urbanization throughout the world, the places for people to live—the places that can still be comfortable and manageable—are disappearing rapidly.

Perhaps most insidious and most damaging are the tensions of urban life and their impact on man as an individual. In some cities

it seems that everything that an individual wishes to do is simultaneously being competed for by others—in traffic, in restaurants, in stores, in apartment buildings. Wherever and whatever direction people go, the increasing number of persons all moving in the same directions with the same ideas brings about a continuous and never-ending tension in the life of these individuals. There have been experimental studies with laboratory animals that indicate that complete disassociation and psychotic behavior can result from tension created by overcrowding. The burgeoning population and expanding urbanization is developing a continuously tension-packed life for mankind—a life that may well be unbearable for many.

Environmental Decisions

There is more and more evidence that population cannot continue to grow at present rates; that man cannot continue to consume goods as he has; and that man must learn that he is a part of and dependent upon the surrounding environment. Change in man's actions seems to be an imperative if he is to survive. Despite this evidence, we continue to make decisions concerning the environment based on the same theories and processes that have produced the current crisis. Dams are being built, power plants are being constructed, highway systems are being developed, land development projects continue, new chemicals are being dumped in massive doses into the environment—all without the type of analysis necessary for quality decisions. The Atomic Energy Commission continues to conduct tests and to set "minimum safety standards," while evidence mounts that there is no minimum at which one is safe from radiation. Factories continue to be built and continue to emit pollutants into streams, rivers, oceans, and the air we breathe. The U.S. Army Corps of Engineers continues its program based on archaic standards. New chemicals are developed and used in large quantity without any understanding of the results.

This problem is exemplified by the impact of detergents. Following World War II, nondegradable detergents were introduced as a substitute for soap. These produced suds in large quantities that could not be removed from inland waters. They were then replaced by detergents that are degradable, a process releasing phosphate in the form of an inorganic nutrient. In turn, this led to the massive increases in algae and other aquatic plants. The result was entrophication in many waters.

Automobiles continue to be driven in ever increasing numbers, with gain in control of emissions progressing at extremely slow rates. In the United States, we have developed a life style and a standard of living that, according to many, could not be supported by this earth for the existing world population. Governments are becoming increasingly incapable of dealing with the problems of the environment, partly because of their organizational structure and partly because they are not set up to deal with problems wholly unaffected by

political boundaries. While division of power within the American government has been useful in many ways, it frequently has become a block to necessary decisions concerning the environment.

Environmental Education

I was asked recently whether the growing interest in environmental education might be a fad, and my answer was that the problems of our environment are not going to go away. They are going to be central and critical to all of our lives, and increasingly so for the young.

Education has been slow to respond to this crisis. Although there has been some development in the area of training technicians, this is still in its early stages. Course development has begun in colleges throughout the country. The urgent press for action has led to the development of courses within the framework of a variety of areas that seem at first glance wholly incongruous. Leading the way are the physical science departments which have developed courses in ecology or environment. Biology departments are active. Courses are springing up in political science departments, social science departments, and even, in one college, in the English department. Important to these developments is that much of the leadership for curricular change is coming from students. Recently at the Florida Association of Public Junior Colleges, the student delegations asked that a course be developed in every community college in the state as a part of the general education program. Such a motion was carried, and its implementation is presently underway. This illustrates the interest of students in this important area.

The development of courses concerning the environment in such a variety of departments really tells one what must be done. The problems are such that a course concerning environment cannot be developed within the framework of any one discipline. The problems are adisciplinary in nature; they require solutions based on contributions from all disciplines.

The general education environmental program requires a new and fresh approach without concern for discipline. In terms of the present condition of our environment and the changes going on about us, it seems that not only should an environmental course be included as part of the general education requirement but in fact should serve as the very core of general education.

Education has long held that the purpose of general education is to prepare people to live more effective lives and to be more effective citizens. Yet, because of the training of our faculty and because of our history, we in higher education have continued to slice off chunks of a variety of disciplines and call that general education. In most cases these slices of disciplines are simply the first steps in what are designed as sequences of courses in the particular disciplines. I believe that the day has gone when we can argue that a portion of the curriculum should be set aside for general education, requiring stu-

dents to take college algebra or chemistry and claiming that such courses are designed to help them live more effective lives. I don't argue that these courses are not worthwhile or that they should not be offered. They should, but they are not general education.

Environmental education offers an opportunity to develop a general education course that will be relevant to students, will be directly attuned to the objectives of general education, and in fact is an imperative for every young American.

Essentially, there are three approaches that can be taken to include environmental education in the general education curriculum. The first is to integrate considerations of the environment into all of the existing discipline-oriented courses. (This approach is going to be tried, will be difficult to accomplish, but could be quite productive.) A second approach, being tried at the University of Wisconsin at Green Bay, is making environmental education the foundation of the entire curriculum. E.E. is not simply integrated into other courses, and not a separate course by itself, but rather the very soul of the whole educational program regardless of curriculum. The third approach is that which will be discussed in some detail in this article—developing an adisciplinary course of one year or more that satisfies general education requirements and that deals with man and environment.

Development of the Man and Environment Course

The *Man and Environment* course has been developed by more than 20 community colleges working cooperatively for nearly one year. During this period, there were two major workshops held, each approximately one week in length, during which the modular approach to the development of a basic understanding by man of his interrelationship with the environment was developed.

The following colleges participated in the development of this course: Berkshire Community College, Massachusetts; Brevard Junior College, Florida; Bristol Community College, Massachusetts; Brookdale Community College, New Jersey; Chabot College, California; City Colleges of Chicago, Illinois; College of San Mateo, California; Community College of Baltimore, Maryland; Community College of Denver, Colorado; Community College of Seattle, Washington; Cuyahoga Community College, Ohio; Dallas Junior College District, Texas; Delta College, Michigan; Essex County College, New Jersey; Fullerton Junior College, California; William Rainey Harper College, Illinois; Miami-Dade Junior College, Florida; Orange Coast Junior College District, California; Portland Community College, Oregon; Seattle Central Community College, Washington; St. Louis Junior College District, Missouri; and Tarrant County Junior College District, Texas.

The *Man and Environment* course has been developed in a modular format to provide a basic framework for the exchange of ideas and material pertinent to the course as it is offered in an individual institution. It is assumed that most institutions developing such a course

would want to use most of the modules; however, because of the individual differences in institutions and areas and the creativity of the individual faculties, each institution may drop one or more of the modules or may add one or more. What is important is maintaining the framework for development; within that framework, ideas, instructional strategy, and plans can be interchanged, and cooperation can be maintained in the creation of instructional materials.

Modules as presently developed are descriptive or subject-oriented. The groups that developed the program felt that behavioral objectives and specific course objectives can be developed within the framework provided by the modular structure. This task remains to be done, however, and might develop in considerably different ways from institution to institution.

In addition, a development of programs that would allow the offering of such a course through open-circuit television is also in progress, and plans for cooperative work and interchange seem especially relevant in this area.

The Man and Environment Course

The *Man and Environment* course is a two-semester, adisciplinary, general education course designed for all community college students. There is an underlying and continuous theme to the course which can be summed up briefly in the following way:

Theme: Great interdependence exists between man and his environment. This interdependence needs to be more deeply recognized, not only for its magnitude but also for its accompanying responsibility of man toward his environment. Involved with this increased recognition of man's responsibility toward his environment will be a heightened awareness of the need for strengthened, revised, or even new solutions to problems of the environment. Where solutions do not exist, they must be found; this is imperative.

This theme is based on certain assumptions about the environment which must be recognized if the theme itself is to be understood. One is that the environment is subject to many changes. A second is that man is an important ecological dominant. Perhaps most importantly, a third is that the environment must be recognized as encompassing much more than is conventionally associated with this term; further, it is influenced by a wider range of factors—both animate and inanimate—than might usually be recognized; and the ways in which man himself reacts to and handles all of this is of the utmost significance as well.

This theme, and its underlying assumptions, account for what may appear to be a remarkably broad range of problems.

Overall Objective: To have students recognize man's interdependence with his environment and his responsibility for it.

General Objectives: To develop awareness and understanding of:

- Self: Need for optimum psychological and social satisfaction
- Nature: Psycho-bio-cultural
- Environment: External; internal; natural; man-made
- Change in the environment: Social institutions
- Interdependence in the environment
- Interaction in the environment: Psycho-bio-cultural
- Consequences of change: Man as an ecological dominant
- Man's responsibility for the environment: Individual, group, governmental
- Our ecological past
- Our obligation to future environment: Survival; the human dimension
- Rational knowledge and the function of habits, emotions, values
- Belief systems
- Environmental problems
- Alternative courses of action toward the solution of environmental problems
- Individual involvement.

The Modules of Man and Environment

The modules included in the *Man and Environment* course are:

1. Ecological Imperatives
2. The Nature of Man
3. Value Systems—Ecological Priorities
4. Belief Systems
5. The Myths of Technology
6. Concepts of Change
7. Earth as an Energy System
8. Environmental Perception
9. Conservation of Vital Resources
10. Population Dynamics
11. Urbanization: The Living Community
12. Water—Supply, Demand, and Pollution
13. Air Pollution
14. Food and Drug Pollution
15. Sound Pollution
16. Scenic Pollution
17. Individual Involvement
18. Wildlife and Man
19. Forests and Man
20. Grasslands and Man
21. Soil and Man
22. Rock and Mineral Resource Management
23. Individual Maladjustment
24. Intergroup Tensions
25. Social Institutions
26. Intergroup Tensions
27. Social Institutions
28. Impact of Political Systems
29. Impact of Economic Systems
30. Communication: Dissemination and Acquisition of Information
31. The Antecedents of Contemporary Problems and Solutions in Ecology
32. Responsibility of Future Generations.

A brief description of each of the modules is included in Appendix 2.

V

The Extent of Environmental Education

Early in 1971, the Center for Curriculum Design at Kendall College in Evanston, Illinois, conducted a mail survey measuring the current and anticipated development in environmental education courses and programs in community and junior colleges. Responses were received from over 600 colleges, or more than half of the two-year colleges in the United States. The results indicated that 35 per cent of the colleges responding offered a course in "environmental studies" at that time, while an additional 16 per cent of the colleges were planning or intend to plan such a course. More than 8 per cent of the colleges responding to the survey indicated that they offered a curriculum or a program in some aspect of environmental studies at that time. And over 25 per cent of the colleges responding indicated that they were either planning or intend to plan a curriculum or a program in the near future. Twenty-six per cent indicated they had no course or program at the time of the survey, but a mere 3 per cent of the colleges indicated that they had no intention of adding either a course or program in "environmental studies" to the curriculum.

Of the responding institutions, only 4 per cent indicated that they had initiated the course or program prior to the 1969-70 school year. More than 25 per cent indicated that 1970-71 was the year in which their environmental studies offering was initiated. An additional 16.5 per cent said that 1971-72 would be the date of initiation. And only 12 per cent indicated that the initiation would be after 1972 or was not decided as yet.

More than half of the institutions responding to the survey said that one of the objectives of their environmental studies offerings was to increase general environmental awareness. In addition, almost 44 per cent noted that a major objective of their environmental studies offerings was to develop appropriate environmental attitudes. More than a third of the responding institutions indicated that stimulating personal action on behalf of environmental causes and issues was also a major objective. Any or all of these could be stated objectives of the general education efforts discussed earlier.

Only 2.7 per cent of the institutions indicated that some interdisciplinary department or division would be in charge of the environmental studies area, and only an additional 3 per cent said that a special department would be or had been created to operate the environmental studies program. A total of 15.3 per cent indicated that the program would be located in the continuing education or community service areas of the college. Yet, almost half of the institutions indicated that the environmental studies program either is or will be conducted by a life science department or division (usually biology), while another 10 per cent indicated that a social or behavioral science department or division would be in charge of their offerings. Centering such educational activities as "interdisciplinary" courses in such discipline-oriented departments raises serious questions about whether they can effectively and validly offer them without considerable bias.

Almost 29 per cent of the institutions responding indicated that a major objective of their environmental education curricula was to train environmental scientists and technicians. About one-third of these institutions indicated that their occupational curricula already were, or in the future would be, in the field of water and sanitation, or a related area. Approximately 20 per cent indicated that their curricula would be concentrated in the area of air pollution. About 19 per cent of the institutions said that waste disposal would be the primary employment objective of their technology programs. Approximately 15 per cent indicated they would offer a program in general environmental technology. Approximately 13 per cent of the institutions offering or planning to offer technology programs stated their curriculum would be in conservation technology. (A complete listing of programs offered or planned is included in Appendix 2.)

In addition to program areas of concern the survey sought information on the institution's need for assistance and the availability of expertise and information in environmental studies in the responding institutions. Almost 70 per cent of those responding indicated a "need for descriptive materials," and 60 per cent stated a "need for curriculum materials." More than one-fourth indicated that they needed consultant services or other "how-to-do-it" assistance. Less than 18 per cent indicated their institution could "provide descriptive materials," and only about one institution in eleven believed that they had

enough expertise to "provide consultants."

Many of the written statements included in the response to the survey provide fair evidence that, while embracing the term "environmental education," many educators have changed neither their courses nor their attitudes. Such remarks as "emphasis is on plants and their environment," in descriptions of courses purported to be environmental, leaves much doubt.

In the previously cited study, indications were that three of every ten institutions offered, or soon would offer, an occupational program in some area of environmental education. Furthermore, these figures generally excluded programs offered in agriculturally related areas, e.g., forest technology and landscaping. This sharply contrasts six programs, identified in the 1966-67 school year, which focussed on water and wastewater technology or environmental health technology.

This discussion of postsecondary occupational programs in environmental education will be introduced effectively by J. N. Carsey, president, and Carl Schwing, professor, of Charles County Community College in Maryland, which offers the largest, if not the oldest, program of occupational environmental education in the nation. Dr.'s Carsey and Schwing discuss the program within the scope of the total college.

VI

Promises and Pitfalls of Environmental Technician Education: The American Community Colleges

J. N. CARSEY, *President,*
and
CARL SCHWING, *Chairman,*
Pollution Abatement Technology Department
Charles County Community College
La Plata, Maryland

Our nation's water, land, and air had once been taken for granted as natural and adequate repositories for the disposal of waste. However, as the population boomed and the nation prospered, these natural resources became filled with refuse, their natural purifying mechanisms were soon overtaxed, and, consequently, public concern mounted. Our contaminated environment has now been viewed as a serious hazard to health as well as a threat to industrial progress. To correct this situation, manpower, management, money, and motivation are needed.

One of the more astonishing phenomena involved in this growth of environmental concern within the last five years has been the development of community college programs to train environmental technicians. Prior to 1965, there were only a handful of two-year colleges with specific programs to train technicians in any environmental field. Two examples were Broome Technical Community College in New York and the Fayetteville Technical Institute in North Carolina. Since 1965, however, over 100 community colleges have become involved in some type of training designed to educate post-secondary students in environmental technology. At last count, approximately 70 community colleges had specific associate degree programs for some type of environmental technician. Another 50 to 100 community colleges are currently in the process of evaluating and planning similar programs.

There are several reasons for this proliferation of environmental technician programs over the past half decade. One of them is the increased financial support for such programs from local, state, and federal governments. Another is the emphasis which has been placed on environmental concerns during the past five years. Still another centers around the desire of many students and faculty to have their college make a commitment in the "environmental area." Certainly training environmental technicians holds a promise for community colleges; however, there are a number of pitfalls. This article will discuss some of the developments in the community college environmental technician training field and will attempt to evaluate some of the significant elements relative to planning these types of training programs.

Typical Programs

There are a variety of environmental training roles which a community college can play. It can offer environmental courses in its liberal arts curricula; it can pursue courses or programs in various environmental areas in its continuing education programs; it can develop a formal career curricula leading to a degree upon completion; or it can present any combination thereof. This article will focus primarily on the formal degree programs, with a brief discussion of their relationships to manpower training.

Most of the degree career technician programs follow the familiar pattern of two years of coursework leading to a degree, the primary objective of the training being the placement of the graduate in a paraprofessional or technician's job.

In a recent article in the *Junior College Journal* of the American Association of Junior Colleges,[1] the environmental technician programs were defined in four major clusters: (1) liquid or water waste, or solid waste treatment and disposal technicians; (2) pest control and food sanitation technicians; (3) urban planning and landscaping design technicians; (4) wildlife management and marine source technicians. This article also defined three levels of training culminating in a 60-hour, two-year degree curriculum.

Most of the degree programs currently in operation require that 20 to 30 per cent of the work be in the liberal arts area with the remainder being "hands-on" technical courses with a heavy emphasis on technical science training. Purdue University conducted a comprehensive environmental curriculum study in 1968-69, and many of the current community college programs have based their programs on the Purdue model. The model consists of a 69 semester-hour curriculum with the following course breakdown: 15 hours of liberal arts, 8 hours of physics, 8 hours of chemistry, 3 hours of biology, 6 hours of math and engineering, 3 hours of air pollution, 8 hours of water and wastewater sanitation, 3 hours of hydraulics, 2 hours of specifications and codes, and 4 hours of environmental health.

There are, of course, a multitude of variations on the theme as well as the specifics within the basic environmental technician curriculum. A partial listing of the variety of titles from community college degree programs around the nation gives one an idea of the diversification available: Water and Wastewater Technology, Pollution Abatement Technology, Environmental Quality Control Aides, Environmental Quality Control Technicians, Air Pollution Technicians, Radiological Health Technician, Sanitary Engineering Technician, Solid Waste Disposal Technician, and Water Sanitation Technician. (A complete listing of environmental curriculums either offered or planned is included in Appendix 2.)

Job Demands and Placement

One of the concerns of those either planning currently or offering environmental technician training programs has been the number and quality of jobs available for the graduates of such programs. Despite several surveys, (notably those conducted in Indiana and Maryland which concluded that there was a considerable number of jobs for technicians in the environmental area) concern is still voiced about the "real" demand for such technicians. These authors believe that the need for these technicians will soon be greater than the community colleges can effectively furnish. In addition to the demands placed by federal, state, and local governments for persons with these qualifications, it is felt that industry, as it attempts to cope with the standards placed upon it by governmental agencies and pressure groups, will find the graduates of such programs extremely attractive. Certainly, many of the jobs currently held by valued industry professionals will be filled much more effectively and less expensively by these technicians.

Nevertheless, any community college pursuing such programs should make some attempt to survey the areas they serve to determine the availability of appropriate jobs for the graduates of their particular programs. We suggest that colleges look beyond any normal survey and personally question local industry as to whether or not these specialized technicians would be beneficial to their own particular situations. Since the jargon of the environmental technician is one which is not always understood by the employment officers of industrial firms, colleges should provide them with the necessary input. Meanwhile, it can be expected that the initial graduates of almost all programs will most likely be placed in jobs which are under the baliwick of a local, state, or federal agency.

Program Spin-Off

The pattern for most of the community colleges actively engaged in environmental technician training is that the college initially develops a two-year degree curriculum in environmental technology or one of the other specialties and finds that this program then spawns spin-off programs of shorter duration. These shorter courses are either

financed by local or state governments or some industrial or federal sponsor such as Manpower Development Training Program or Project Transition. For example, at the Charles County Community College the initial development consisted of a formal two-year degree program—Pollution Abatement Technology. However, in addition to this program, there are now a number of short courses or specialized training projects under the aegis of institutional training, veterans training, courses for state and regional wastewater treatment operators, etc. These programs may well grow until they have more students than the more formal, more highly structured, technician program which the college originally developed. It should be noted that these specialized manpower training projects often place strains on the college in relation to its academic posture. Thus, it is imperative that the college develop a clear policy regarding its role in manpower training. Despite their appeal, because of increasing federal money, they are difficult to implement and demand flexibility. A partial list of colleges currently involved in three of these kinds of specialized manpower training projects follows.

Water Quality Office—Project Transition:
- Charles County Community College, La Plata, Maryland
- Fayetteville Technical Institute, Fayetteville, North Carolina
- Central Texas College, Killeen, Texas
- Orange Coast College, Costa Mesa, California
- Fort Belvoir, Virginia
- Fort Bragg, North Carolina
- Fort Hood, Texas
- El Toro Marine Base, California

Water Quality Office—Institutional Training:
- Charles County Community College, La Plata, Maryland
- Atlanta Area Technical Institute, Atlanta, Georgia
- Meramec Community College, St. Louis, Missouri

Water Quality Office—On the Job Training:
- Charles County Community College, La Plata, Maryland
- Tippewa Regional State, Lafayette, Indiana
- Mallory Technical Institute, Indianapolis, Indiana
- St. Joseph Institute, South Bend, Indiana
- Northwest Technical Institute, Gary, Indiana
- Linn Benton Community College, Albany, Oregon

Program Costs

One of the pitfalls of environmental education programs is their high cost. It is our personal opinion that it is difficult to conduct a quality environmental technology program on a community college campus at less than $2000 per year, per full-time equivalent student. In addition, the programs require specialized equipment and facilities. Many colleges have cooperative facilities arrangements: but, it is to

the advantage of the college if it can afford a separate occupational area for special labs as well as have specialized equipment. At the Charles County Community College, for example, we have bought or are in the process of buying approximately $500,000 worth of specialized laboratory equipment for our three environmental technician programs.

Although there is state and federal support for environmental training projects, it is not always easy to acquire these funds and, in almost all cases, there are not enough state and federal monies to do all that needs to be done. It is also extremely difficult to obtain funds for major equipment. What follows is a brief sample of some of the possible sources of federal income for these programs.

The Environmental Protection Agency has financed curriculum development programs and is in the process of establishing criteria for on-going support of quality environmental technician programs around the nation. The U.S. Office of Education has offered some curriculum development support and will inevitably increase its help to specific areas of environmental education needs through its E.E. group. The National Science Foundation has recently financed curriculum development work at the Charles County Community College and will undoubtedly be looking for the means to help support the more innovative environmental projects of the future. The National Sanitation Foundation has supported some staff development in the past and will probably provide certain types of financial support in the future. As noted above, a number of the community colleges have become involved in Manpower Development Training Acts, Project Transition, or other specialized certification training programs. Also, foundations are interested in funding innovative concepts. The Kellogg Foundation recently announced a grant to the Superior State College in Michigan for a two-year curriculum development effort in an environmental area. Other foundations undoubtedly will be putting some money into environmental training in the future. One fact is certain: it is necessary, due to the high cost of environmental programs, to develop a diversified base of income support.

Environmental technology programs are expensive and need strong financial support as well as a commitment on the part of the college and governmental agencies. One of the support needs of the future, which will demand the attention of both state and federal agencies, is the need for scholarships and stipends for students who are interested in environmental technician programs in the community colleges around the nation. Some of these stipends undoubtedly will have to come from industry.

Recruitment

It is difficult to recruit students for these technician programs. However, the environmental technician programs have one advantage in attracting students, and that is youth's current commitment to help

solve environmental problems. Despite this, any college offering environmental technology programs will have to develop techniques for attracting students and motivating them to succeed in these programs. In addition to a strong recruitment program, each college must have a very competent placement program in order to see that the graduates of these types of programs get the best possible jobs available in their field.

Other Key Elements

In addition to what has been discussed previously, the environmental education training programs open up a number of areas for the college to consider. One of these is residential housing. Once a community college dedicated to serving the commuting student devises a highly specialized environmental training program, students from outside the commuting area become attracted. The college must then cope with the problems of financing the students as well as housing them.

The international dimensions of environmental training for the technician are rather awesome. As more and more developed nations find that they have a great need for trained personnel to cope with the problem of pollution, the concept of environmental technician training will take on worldwide dimensions.

As colleges develop more highly specialized environmental training programs, there will undoubtedly be a movement toward evolving core curricula which will be utilized to train generalist environmental technicians. The core curricula can then be used as a base from which the technician specializes.

The relationship of the environmental training programs to the other curricula given by a college will receive attention. More students are demanding coursework in the environmental area in their liberal arts programs and are choosing to take environmental courses as electives in their transfer curricula. The college itself, once it becomes committed to the environmental programs, will find that there are "spill-overs" from its technology programs into other curricula on campus.

The increased emphasis on public service careers that will be seen in the next decade undoubtedly will precipitate environmental training programs which are basically part of the public service "cluster."

The political dimensions involved in setting oneself up as an expert in environmental programs are many. Working with local officials is imperative for support and commitment to this issue. The concept of community service is inherent in all community colleges and is seen in the environmental area more than in any other. Many of the colleges currently involved in environmental training find themselves acting as consultants to the local government in such areas as sewage plant operation. At the Charles County Community College, we have become involved with several municipalities and counties in roles

which complement the development of specialized curricula.

A Look at the Future

There seems to be no doubt that environmental technician education will continue to grow and prosper. However, within the next decade, there will probably be a "shake-down" of those colleges and universities offering technician training so that only those programs with a certain level of quality will survive. Not only will the quality programs require instructional excellence, but also they will depend upon competent recruitment and placement, good diversified financing, a commitment by the college to the concerns of the environment, and a willingness by the staff to be innovative. Certainly there would seem to be no technician program for which the need for instructional innovation will be more in demand than in the environmental area. The promise of the future for quality environmental training programs is a bright one: the pitfalls, for the unwary, are many.

Several of the issues and problems surrounding occupational programs in environmental education were just introduced from the point of view of personnel in a comprehensive community college. Consideration of the issues from a different perspective is made in the following paper by Edward F. Mackin. Dr. Mackin, a professor at Harvard Business School and an associate of Olympus Research Corporation, views the occupational programs from the point of view of a labor economist. Many of the same issues are as sharply drawn by Dr. Mackin as in the previous paper. Furthermore, he addresses himself to a few different ones which are of tantamount importance when considering the scope of environmental education.

VII

Environmental Manpower and the Interchangeable Technician

EDWARD F. MACKIN
Consultant to the U.S. Office of Education
(on leave from Harvard University)

In the early spring of 1970, the Manpower Development and Training (M.D.T.) Division of the U.S. Office of Education urged the U.S. Department of Labor to earmark certain reprogrammed funds for use in the field of environmental management. Working in close cooperation with M.D.T. program officers in each of the ten U.S.O.E. regional offices and with community colleges across the country, both the Department of Health, Education, and Welfare and the Department of Labor committed $5.5 million to train over 2,500 unemployed persons for environmental related occupations and over $11 million to train more than 3,500 health related workers.

This U.S.O.E. project was initiated in response to the Administration's concern over the nation's environmental manpower needs so essential to implementing the Environmental Policy Act. While the primary purpose of the environmental manpower project was to train the unemployed and disadvantaged in attractive and emerging career fields, it also tested the ability of a relatively new segment of education to respond quickly to a critical national occupational need; the new factor was and is the community college. Responding to the public's growing concern over pollution, resource depletion, and community health, many additional schools and colleges and manpower training agencies plan to offer programs in various environmental career fields. Yet, this rapid build-up in response to a high national priority has raised serious questions at the regional, state, and community levels. The most important question asked . . . What is the actual need for trained manpower?

Evidence supporting the need for training in environmental management occupations is available from the estimates of two federal agencies in the environmental field. In the area of water pollution control alone, the Federal Water Pollution Control Administration (later the Federal Water Quality Administration, F.W.Q.A., and presently the Water Quality Office of the Environmental Protection Agency), in its first report to Congress in 1967, projected an increase of 23,200 technicians between 1967 and 1972—a 225 per cent increase in a single occupational speciality! (See Table 1.) The Environmental Health Service (E.H.S.) stated that the 1968 supply met 80 per cent of the need for environmental health technicians with the gap between supply and need expected to expand to nearly 40,000 persons by 1980. (See Table II.)

Both the E.H.S. and the F.W.Q.A. manpower forecasts are limited to existing, but narrowly defined, technical specialties, e.g., water pollution control technician. What are the employment opportunities for a broadly trained technician in pollution control? In 1968, an environmental manpower study covering the State of Indiana was conducted by Professor J. P. Lisack of the School of Technology, Purdue University.[1] More than 80 per cent of the employers contacted expressed a strong interest in a two-year associate degree graduate capable of working interchangeably in any one of the three major pollution areas: air, water, or solid waste.

As a result, in September 1970 Purdue University first offered a two-year associate degree program based upon a pollution control core curriculum. Purdue is currently planning specialized courses in thermal, radiation, and accoustical pollution control technologies for those who wish to build up a broad-based foundation program.

The Lisack study of manpower need was limited to the State of Indiana and to selected aspects of environmental management. Although there are obvious limitations in extrapolating this data to ascertain a total spectrum on a national basis, the study can be used to provide a conservative estimate of environmental control technician need.

In 1968, Lisack ascertained that the "average annual recurring requirements" for pollution control technicians in Indiana was 230. This author examined Lisack's original data and, in working with Lisack, verified both his calculations and analysis. If the established need in Indiana can be extrapolated to the national level, on a basis proportional to Indiana's share of national population, a 1968 national annual recurring need of approximately 10,000 technicians is indicated for "pollution control technicians" in water pollution control and solid waste disposal alone.

A wide range of numerical estimates was produced by these three separate and independent manpower forecasts, but this data refers to a very limited number of technical specialities. These specialities are limited to pollution control and do not include any of the numerous

TABLE I
MANPOWER NEEDS IN WATER POLLUTION CONTROL
Estimates of Manpower Requirements

Employers	Fiscal year 1967			Fiscal year 1972								
				Professionals			Technicians			Sewage treatment plant operators		
	Professionals	Technicians	Sewage treatment plant operators	Current estimate	Estimated increase	Per cent increase	Current estimate	Estimated increase	Per cent increase	Current estimate	Estimated increase	Per cent increase
State Agencies	1,368	317	—	3,422	2,054	150	980	633	209	—	—	—
Local Agencies	2,250	2,250	20,000	5,550	3,250	144	5,500	3,250	144	30,000	10,000	50
Subtotal	3,600	2,600	20,000	9,000	5,400	150	6,500	3,900	150	30,000	10,000	50
Solid Waste Treatment	1,700	1,700	3,500	6,000	4,300	253	6,000	4,300	253	12,000	8,500	243
Sanitation Engineers	6,000	6,000	—	21,000	15,000	250	21,000	15,000	250	—	—	—
Total	11,300	10,300	23,500	36,000	24,700	219	33,500	23,200	225	42,000	18,500	80

Numbers are rounded.

Estimated by Black & Veatch, Consulting Engineers.

SOURCE: "Manpower and Training Needs in Water Pollution Control." Report of the Department of the Interior Federal Water Pollution Control Administration to the Congress of the United States in compliance with Public Law 89-753, August 1967, p. 15.

TABLE II
MANPOWER SUPPLY AND DEMAND
Associate Degree Environmental Health Technicians

Degree	1968 Supply	1968 Need	1975 Supply	1975 Need	1980 Supply	1980 Need
1. Water Supply	23,000	35,000	38,000	47,000	47,000	59,000
2. Waste Water	27,000	33,000	56,000	70,000	90,000	112,000
3. Radiological Health	400	500	1,000	1,200	1,600	2,000
4. Solid Waste Management	3,400	4,200	6,500	8,200	9,000	11,000
5. Air Pollution	400	500	960	1,200*	1,390	1,800
6. Sanitation Control	5,000	6,000	8,000	10,000	10,000	12,000
Total	59,200	79,200	110,460	137,600	158,990	197,800

SOURCE: *Manpower Supply—Environmental Health Technicians.* Table 3, Office of Training and Manpower Development, Environmental Health Service Administration. September 1969, p. 7. (Figures for earlier dates deleted in the above table.)

* In a more recent study by the National Air Pollution Control Administration (June 1970), technician employment in the *private sector alone* was 828 in 1969 with a projected need for 3,172 air pollution control technicians by 1974. Therefore, the E.H.S. projection for air pollution technicians appears to be conservative. *Manpower and Training Needs for Air Pollution Control—Report to the President and the Congress.* (N.A.P.C.A.) U.S. Department of Health, Education, and Welfare, June 1970. Washington, D.C.

other occupations in environmental management, such as resource conservation. Nevertheless, a low estimate of 10,000 for 1968 for generalists in air and water pollution and solid waste management (Purdue study) compared with an estimate of 23,000 new wastewater control technicians in 1972 (F.W.Q.A.) indicates an expanding need for a rapid build-up of training in environmental management occupations. Resource conservation and pollution control, though interrelated branches of environmental management, require manpower possessing different skills. It would be desirable to display the results of manpower needs studies in resource conservation in addition to those already displayed for pollution control. Such studies do not exist.

Our Recent Manpower Development and Training Experience

The manpower emphasis of the past decade has been placed upon the remedial needs of those who enter the labor market without adequate preparation and find themselves at a disadvantage in the competition for jobs. The manpower programs developed in response to these needs have not only contributed to the rehabilitation of these individuals, but have also provided guidelines for improvement of occupational preparation in the schools and for upgrading and continuing the education of adult workers. Of particular significance have been the Job Corps Urban Centers, the M.D.T. skills centers, and the school-employer relationship of coupled institutional and on-the-job training. The pressing economic needs of these workers, their impatience with training which was not job related, and the limited budgets relative to widespread eligibility for the programs dictated lean curriculums pared to essentials. Release from many institutional contraints encouraged innovation. New methods have been tried and discarded or incorporated, based on their effectiveness. Measures used only occasionally elsewhere have been perfected and become standard.

Educational attainment was found to have a limited correlation with native ability, particularly for minority groups. Cultural deprivation during childhood was proven to be a remedial handicap in determining ability. Skill training programs, it was learned, could not assume basic educational skills. In fact, an industry emerged to supply basic education to adults. The promise of a job proved to be the motivating factor which made the difference between learning as a child and as an adult. When basic education is job related and integrated with skill training, the more acceptable and motivating it becomes. Past exposure to the world of work has proven too limited to enable valid occupational choices. Existing tests have been too culturally biased to assess potential capabilities. As a substitute, prevocational orientation and work-sampling techniques were developed. Counselors found they could not be merely impartial sounding boards aiding in self-analysis, but that they must be advocates in the solving of personal problems, as well.

Faced with the pressing financial needs of their clients, the training programs could not wait for the beginning of an academic year, semester, or quarter. Training had to be available when needed, rather than on a conventional timetable. Poverty and unemployment were the only prerequisites, and educational background was immaterial. Admissions had to be open to anyone eligible and motivated, regardless of preparation. The institutions had to adapt to individual needs, rather than individuals adapting to institutional rigidities.

Training modules were developed allowing continuous admittances which, in turn, demanded individualized instruction. Varied capability, interest, and financial ability demanded a ladder arrangement among a cluster of occupations, allowing each enrollee to seek his own level. Despite differences in learning speed, almost any skill could be taught with sufficient time, and some level of employability could be provided to anyone willing to try. A "zero reject" policy was a possibility. Placement services had to be integrated with training to prevent losing the training completed between the school, the employment service, and the employer. With placement services on site, the school could not declare success until employment had resulted. Even after placement, follow-up was necessary until the inexperienced worker and the supervisor of conflicting ethnic background had reached accommodation and personal adjustments had been made. For those from very disadvantaged backgrounds and burdened with disfunctional life styles, job coaches to improve attendance and deportment, training and grooming, etc., were added.

The schools which had tended to ignore the critical importance of placement and job experiences, and the placement agencies who concerned themselves little with the value of formal training, found accommodation. Less restrained by institutional and legal requirements, the essential ingredients of staff capability were clarified. Skills best learned in the training institutions and those best learned on the job were identified. So were the relationships between skill training and supportive services.

The possibilities for restructuring jobs, for spinning off subprofessional tasks from professional work loads, and for substituting experience and sympathetic understanding for formal training and credentials were other gains.

This presentation is overidealized. Many of the problems still exist. No institution has adopted all the available innovations. Some approach the described model, and others are far from it. Yet viewing the system as a whole, a concept of best practice has emerged and the lessons are beginning to infiltrate education and training outside the manpower programs.

These developments within manpower programs are relevant to environmental manpower needs because they offer attractive employment opportunities to disadvantaged workers. Accomplishments of manpower training have often been tarnished by a tendency to shunt

the disadvantaged into occupations below their potential capability. At times the motivation has been the immediate income needs of the worker, but more often it was the budgetary pressures to keep per-trainee costs at a minimum and enrollments at a maximum. In an effort to pull together community college and other post-secondary school administrators and federal, state, and local M.D.T.A. officials, a series of "Administrator's Environmental Manpower Teach-Ins" was held during the period of October 1970 through January 1971 in each of the ten Department of Health, Education, and Welfare regions. At these teach-ins the community college leaders learned of the environmental manpower needs and the possibility of M.D.T.A. funding. The M.D.T.A. officials learned of community college capabilities. The teach-ins resulted in proposals for projects to prepare M.D.T.A. eligible, primarily disadvantaged persons for skilled and technician jobs in environmental management.

Developing Generalizable Education Programs in Environmental Management

In March 1970, as a result of the Department of Labor and the Bureau of the Budget's decision to reprogram certain funds jointly administered by the Department of Health, Education, and Welfare, and the Department of Labor, the U.S. Office of Education prepared a plan to utilize certain of these reprogrammed funds for environmental education activity. There were two parts to this plan. The first phase, or initial activity, focussed on the immediate need for training programs. The $5.5 million program utilizing reprogrammed J.O.B.S. money was described earlier in this paper. It is noteworthy because it drew upon a tremendous national resource scarcely used by M.D.T. administrators, the community college, and similar postsecondary education institutions.

The second part of the plan took a long-term view and is described in a formal document: "A Comprehensive Training and Placement System for Certain Priority Populations for Supporting Roles Within the Emerging Field of Environmental Management." This memorandum was prepared as a plan that would qualify under the legislation covering the reprogrammed Health, Education, and Welfare/Labor Department funds. The Commissioner of Education and the Secretaries of H.E.W. and Labor endorsed the two major concepts advanced in these planning documents: (1) train the unemployed and disadvantaged for environmental occupations, (2) develop an "interchangeable technician" for employment across a branch of environmental management including pollution control, resource conservation, and community health. As part of this endorsement, the commitment was made that U.S.O.E. in cooperation with the Department of Labor would support $14 million of manpower training in environmental and health related occupations.

The concept of the "interchangeable technician" is not a totally new

idea. In fact, the President's Council on Environmental Quality recommended in their first Report to Congress:

> There is need for new programs to train technicians who have fundamental technical skills and who can easily adapt to constantly emerging job categories. It may be possible, for example, to modify, coordinate, or merge some of the present specialized technician programs into broader environmental technician programs.[2]

Why is it desirable to merge "specialized technician programs into broader environmental technician programs"? The answer is central to the entire field of environmental management. An adequate response to this question will require at least a brief review of the root cause of environmental deterioration, a very brief analysis of the changing labor market, and a statement concerning the relevance of both these topics to the needs of vocational education research.

Why Has Man Damaged His Environment?

Man is a single unit in a vast and complex eco-system (eco, or house, is a precise term for describing man's natural habitat). But he is the only organism so totally committed to shaping his environment according to his own desires rather than adapting himself to the dictates of his environment. It is this development urge which is the source of his achievements. The problem is that man's ability to make development decisions is far more advanced than his ability to understand his environment. Competition, the profit motive, and other incentive systems have rewarded his development capacity. The fragmentation of tasks and the high degree of occupational specialization characteristics of modern industrial technology tend to exacerbate the problem. Man's awareness and perception of his environment have lagged far behind his technical ability, while a frontier psychology has led him to believe that his natural environment is limitless.

In the final analysis, reconciling development and conservation depends upon a skillful sorting of goals and values, both public and private. Pollution is not an inevitable consequence of development. However, before we can establish "harmony between man and his environment" we will need a far better understanding of our ecological system and a vastly superior method for allocating our national resources. It is not enough merely to check and control known sources of environmental pollution. We must begin to pursue a new work ethic, and its success will depend on our ability to learn how to pursue development activities that *add* to the quality of our environment.

This is the real challenge of the Seventies. While it is impossible to perceive the full range of consequences implied in this new environmental ethic, there is a clear call to seek new techniques, procedures, and innovative practices in all areas of life if all Americans are to enjoy the benefits of our post-industrial society.

The Changing Labor Market

The assembly-line approach to mass production was the genius of the industrial revolution. Man and machines specializing in even narrower segments of production processes would result in the maximum output per unit of input. As a result, the *Dictionary of Occupational Titles* currently contains approximately 30,000 titles. But in many areas of employment, the pendulum is reversing. The reasons are both human and technical, but they all affect efficiency.

Narrowly specialized individuals are more vulnerable to technological and economic change. Workers seek a broader base of skills to reduce the threat of technological obsolescence and displacement. A widespread lack of commitment is startling employers, leading them to reexamine the arguments for specialization. The *Wall Street Journal* recently reported a persistent increase in absenteeism, despite the rising unemployment which usually causes employees to value their jobs more highly. High incomes might explain this apparent preference for leisure. However, the April 1970 *British Science Journal* notes that rising absenteeism is a world-wide phenomenon. Workers are simply not as interested in, attached to, or concerned for their jobs to the extent they have been. In response, as reported in the September 1970 *Fortune* magazine, many American employers are resorting to job enrichment. Rather than simplifying jobs to reduce the skill requirements, they add to the complexity, seeking to increase challenge and reduce boredom. Rather than specialize assembly tasks, they allow an employee to assemble a whole device, hoping for him to gain a sense of accomplishment. The desire of more and more people to "do their own thing" creates restlessness under supervision. It establishes the need for a broadened understanding and the capability for more autonomous activities.

Several factors affect the technical side. Consumer demand for greater variety in products reduces the length of production runs. New products emerge and older ones decline with great rapidity. Employers find themselves handicapped by overly specialized employees. They seek more adaptable workers who can be shifted about as manpower requirements change. Specializing assembly line production was one thing, specializing service functions is quite another. Customers, whether for public or private services, are unwilling to be treated mechanically and, in effect, be transferred from one individual to another as on a human assembly line. The service worker must perform a wider variety of tasks, filling many of the related needs of a particular customer. Professional and technical workers, the fastest growing proportion of the labor force, are expected to have a broad understanding of their profession or technical assignment and be able to perform a variety of interrelated activities with minimum supervision. Fear and frustration interfere with employee efficiency and increase costs. Overspecialization is costly in reduced scheduling

flexibility. The growing fringe-benefit structure adds to the costs of changing employees as technology changes. For all these reasons, the very specialization which once minimized production costs often adds to them.

With awareness of threats to the human environment, another cost emerges. The individual who understands only the immediate objective of his own technology in this complex world is a threat both to society and to the environment. The profound but hitherto unforeseen impacts of technological change demand a new technician. He must be broad enough in his outlook to understand the interrelationships and long-run impacts of various technologies and guard against harmful side effects. In vocational schools with their cluster concepts, in the expansion of postsecondary technical training, in the growing professionalization of some formerly technical occupations, and in team relationships between professional and paraprofessional employees can be noted a persistent trend to a broadening functional approach, a response to the demands for adaptability. The opposite is true, as well. Functions never before very specialized (for example, construction and auto repair) are now being subjected to assembly line processes. But the cycle will probably be repeated: from handicraft production to specialization to job enrichment and adaptability. Because they are at the forefront of change, environmental management occupations appear likely to bypass steps in that development and emerge directly with technical-professional interchangeability.

Many environmental specialities (such as wastewater treatment) are conventional and well established technician occupations. Others are only now beginning to emerge in the nation's labor markets. A careful examination of the actual job descriptions of many of these specialities will indicate a common skill base. For instance, proficiency in microscopic techniques is only one example of a skill and knowledge requirement applicable to the testing room of a sewage treatment plant, the laboratory of an industrial firm, or a local public health unit. Basic cartographic skills including drafting, use of survey instruments, and photo reproduction processes represent another set of essential skills required of numerous technical specialities in resource conservation. A working knowledge of ecology and basic ecosystems is as fundamental to the environmental technician as a working knowledge of mathematics is basic to the engineering technician.

The possibilities can be illustrated using the Purdue/Lisack study quoted earlier. It will be recalled that industry in the State of Indiana expressed a strong preference for an associate degree technician capable of functioning in air or water pollution control or in solid waste management. The present is represented at position 1, focussing on the highly specialized technician in a single branch of environmental management technology, e.g., air pollution control or soil conservation specialists. The Purdue/Lisack model combines three branches of pollution control: air, water, and solid waste. It is, therefore, located

at position 3 on the scale. The "interchangeable technician" is placed at position 10 on the scale thus representing a desirable target for systematic research and development. The interchangeable technician represents a goal or a concept both education planners and manpower program directors can use as a target to be achieved in the decade of the Seventies.

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1. Lisack, J. P. *Manpower Requirements for Pollution Control and Water Resources in Indiana and a Related Pollution Control Technology Curriculum.* Manpower Report 69-1. Lafayette: School of Technology, Purdue University. 1969.

2 *Environmental Quality.* The First Annual Report, Council on Environmental Quality. U.S. Government Printing Office, Washington, D. C. August 1970.

VIII

Career Fields Included in Environmental Education

Under the broad, general definition adopted by the U.S. Congress in the Environmental Education Act of 1970 (see Chapter II), environmental education encompasses population growth, pollution, resource allocation and depletion, conservation technology, and urban and rural planning. Many curricula which prepare students for entry into jobs are now considered a part of environmental education. One of the first specific attempts to list and classify the array of programs now considered to be included in E.E. was made at the Community College Environmental Ecological Technician Education Workshop held in Denver in the summer of 1970.[1] At this workshop, four clusters of environmental jobs exhibiting similar characteristics were identified. These clusters were called:

1. Pollution prevention and control
2. Disease prevention (non-patient care); alternative titles included public health, sanitation, community health, and environmental health
3. Environmental planning
4. Resources control.

The December/January *Junior College Journal*[2] lists the titles of occupational curricula to be offered in 1971-72 in junior colleges and technical institutes. A few of these titles are much more common than the others. For example, the title Environmental Technology

is by far the most prevalent one used. Water and Wastewater Technology is also widely used.

TABLE III

ASSOCIATE DEGREE OCCUPATIONAL PROGRAMS IN ENVIRONMENTAL/ECOLOGICAL EDUCATION

Pollution Prevention and Control

Air and Water Pollution Technology
Air Pollution Technology
Air Pollution Control Technology
Atmospheric Monitoring
Chemical Technology (Environmental Sciences Option)
Civil Engineering Technology (Sanitary Option)
Environmental Control Technology (Air Pollution Option)
Environmental Control Technology (Hydraulics Engineering Option)
Environmental Control Technology (Sales and Service Option)
Environmental Control Technology (Water Pollution Option)
Environmental Engineering Technology
Environmental Sciences Technology
Environmental Studies
Environmental Technology
Pollution Abatement Technology
Pollution Abatement Technology (Air pollution option)
Pollution Abatement Technology (Water and waterwaste option)
Pollution Control Technology
Sanitary Technology
Sanitary Engineering Technology
Sanitation and Water Treatment
Wastewater Technology
Water and Air Pollution Technology
Water and Wastewater Technology
Water Pollution Technology
Water Pollution Control Technology
Water Sanitation Technology

Disease Prevention (non-patient care)

Environmental Health Technology
Environmental Health Engineering Technology
Pest Control Technology
Radiation Monitoring
Radiation Science
Radiological Monitoring
Water Treatment Technology

Environmental Planning

Environmental Community Planning and Development Technology
Landscape Design Technology
Park Management
Park and Recreation Management
Traffic Engineering Technology
Urban Assistant
Urban Planning Technology
Urban Professional Assistant

Resources Conservation

Conservation Technology
Estuarine Resources Technology
Fish and Wildlife Management
Forestry Management
Forestry Technology
Marine Resources Technology
Marine Biology
Marine Technology
Natural Resources Technology
Ocean Engineering Technology (Ecology option)
Oceanographic Technology
Range Management
Recreation Assistant
Soil and Water Conservation Technology
Water Resources Technology
Soils Technology
Wildlife Management

In the cluster of disease prevention, only the environmental health technology and radiological health technology curricula were offered in the two-year colleges during 1970-71. However, others are planned for addition during the 1971-72 school year in at least one institution. In the environmental planning cluster, the park and recreation management and urban planning technology courses have been offered for several years in one or two colleges. The others were either begun in 1970 or are planned during the 1971-72 school year. The programs included in the resources conservation cluster have more tradition and longevity than those in any other cluster. For example, forestry technology programs have been offered for some years in many two-year colleges; marine technology and oceanographic technology curriculums have been offered for three or four years in a few colleges. In addition, wildlife management, recreation assistance, range management, and fish and wildlife management have been offered in a few institutions.

The list compiled at the Denver Community College workshop included technicians prepared in all of these curricula as well as additional ones, some of which have not as yet been offered as occupational. The community college workshop grouped the environmental occupational specialties as follows:

1. Pollution Prevention and Control Technology
   - Liquid waste and wastewater disposal technicians
   - Water treatment technicians
   - Solid waste treatment and disposal technician
   - Air pollution technician
   - Noise control technician
   - Nuclear-radiological pollution control technician
2. Disease Prevention Technology (non-patient care)
   - Water quality technician
   - Pest control technician
   - Environmental health technician
   - Food sanitation technician
3. Environmental Planning Technology
   - Land-use planning technician
   - Urban planning technician
   - Traffic engineering technician
   - Industrial environmental technician
   - Landscape design technician
   - Parks—recreation technician
   - Construction engineering technician
4. Resources Conservation Technology
   - Soil conservation technician
   - Water conservation technology
   - Meteorological technology
   - Forestry or timber conservation technician

Mineral conservation technician
Wildlife management technician
Marine resources technician (ocean)
Fisheries resources technician
Recreation resources technician
Plant pest control technician
Range management technician
Fire control technician

Although jobs must realistically be considered as a spectrum, the workshop decided to describe a limited number (arbitrarily limited to three) of discrete job levels to be used as bench marks during the process of task analysis. These job levels for which a baccalaureate degree is not required for entry were:

Environmental and ecological technician aide (non-degree) for which education and training should be focussed on providing an early job entry within a cluster and developing specific skills enabling the technician aide to collect, monitor, record, and report environmental data. Little previous educational background was assumed for the students entering this level, this being a likely educational entry point for many high school dropouts.

Environmental and ecological technician (non-degree) for which education and training should develop skills and knowledge enabling analysis, operation, and maintenance of environmental systems and equipment. It was assumed that anyone qualified to be a technician aide, and students having completed high school, should be admitted to programs of this level.

Environmental and ecological technician (associate degree required) for which objectives of education programs will vary according to individual college requirements. Anyone qualified to be an environmental and ecological technician (non-degree) and those high school graduates presenting stated admission requirements should generally be admitted to this level program.

The workshop also categorized environmental jobs according to tasks performed on the job. The categories identified and examples of tasks included in each job category were:

1. Monitor (measurements, analysis, collection, quality control)
2. Operator (processor, aide)
3. Communicator (drafting, graphics, report writing)
4. Maintenance (calibration)
5. Regulation (inspection)
6. Marketing (sales).

Another taxonomy of these careers is given in an inventory[3] prepared for the Environmental Control Administration of the U.S. Department of Health, Education, and Welfare and completed in December 1970. The inventory resulted from a contract study to

provide a comprehensive and consistent set of titles and descriptions for environmental management occupations.

This inventory divided all environmental management occupations into four broad, functional groups. The first two groups include only professional positions, while the last two include supportive personnel of various types.

The groups included in the inventory, in the terms used, are as follows:

1. Science Group (occupations)
   - Bacteriologist
   - Biochemist
   - Biologist
   - Chemist
   - Entomologist
   - Environmental Scientists (Sanitarian)
   - Epidemiologist
   - Geologist
   - Health Physicist
   - Industrial Hygienists
   - Physician
   - Meteorologist
   - Microbiologist
   - Statistician
   - Toxicologist
   - Veterinarian
2. Engineering Group (program category)
   - Air pollution control engineering
   - Environmental engineering
   - Industrial hygiene engineering
   - Solid waste systems engineering
   - Water systems engineering
3. Environmental Surveillance, Enforcement, and Technical Support Group (occupational titles)
   - General sanitation inspector
   - Food and drug inspector
   - Air pollution control inspector
   - Vector control inspector
   - Radiation control inspector
   - Water pollution control inspector
   - Air pollution control technician
   - Water pollution control technician
   - General sanitation technician
   - Instrumentation technician
   - Laboratory technician
   - Engineering technician

4. Facilities and Systems Operation Group
(occupational descriptions by categories)

Solid Waste Disposal Facilities
a. Disposal plant operator
b. Disposal plant supervisor

Water Treatment Facilities
a. Plant operator/journeyman
b. Plant operator/supervisor
c. Plant superintendent

Wastewater Treatment Facilities
a. Plant operator/journeyman
b. Plant operator/supervisor
c. Plant superintendent

Miscellaneous Technical and Manual Support Services
a. Laborer (refuse collection)
b. Laborer, supervisory (refuse collection)
c. Truck operator (heavy duty)
d. Equipment operator (landfill)
e. Crewman (water and wastewater)
f. Machine/equipment operator (water and wastewater)
g. Serviceman (water and wastewater)
h. Pumping station operator
i. Pumping station supervisor
j. Community water wells supply system operator
k. Water well mechanic (equipment, installation, maintenance)
l. Water well drilling operator (rig)

In addition, the inventory breaks down each occupation in the first three groups into a hierarchy of occupational levels or levels of responsibility. The *science group* and the *engineering group*, are generally divided into the levels of journeyman, supervisor, and administrator. The *environmental, surveillance, enforcement*, and *technical* support are delineated only into the levels of journeyman and supervisor. Some statement is made regarding the tasks assigned to each of these levels, and the training and experience required for each.

As recognized by the authors of the study, the inventory is just that. It is an explanation and description of the present state of the art in environmental management. Even though new jobs are being created, old jobs are being combined under new titles, and old skills applied to new problems, the data in the inventory does not reflect these changes.

A third classification of environmental careers is included in a recent publication by Odom Fanning.[4] This book classifies the careers in five general groups. However, it is pointed out that there are many "interdependencies and interrelatedness" among these groups. This is

evident upon inspecting the categories as presented by Fanning, as well as those quot[illegible]above.

The career [illegible]oups as outlined by Fanning are as follows:

1. Ecology
   - Agronomy
   - Animal control biology
   - Entomology
   - Fish hatchery management
   - Fish management biology
   - Fishery research biology
   - Forestry
   - Horticulture
   - Parasitology
   - Range conservation and range management
   - Soil conservation
   - Soil science
   - Wildlife refuge management
   - Wildlife management biology
   - Wildlife research biology
2. Earth Sciences
   - Geology
   - Geophysics
   - Meteorology
   - Oceanography
3. Resources and Recreation
   - Fisheries conservation
   - Forestry
   - Range management
   - Soil conservation
   - Wildlife conservation
   - Park and recreation management
4. Environmental Design
   - Architecture
   - Landscape architecture
   - Urban planning
   - Consulting engineering
5. Environmental Protection
   Environmental scientist
   - Sanitary sciences specialist
   - Air pollution meteorologist
   - Environmental control chemist
   - Estuarine oceanographer
   - Ground water hydrologist
   - Health physicist
   - Limnologist

Environmental engineer
- Sanitary engineer
- Air pollution engineer
- Hospital engineer
- Industrial hygiene engineer
- Public health engineer
- Radiological health engineer

Environmental technologist
- Sanitarian
- Air pollution specialist
- Industrial hygienist
- Radiological health specialist

Environmental technician
- Sanitarian technician
- Environmental engineering technician
- Radiological health technician (monitor)

Environmental aide
- Sanitarian aide
- Environmental engineering aide
- Sewage plant assistant
- Waterworks assistant

The last group consists of a number of specialists at various occupational levels, and can be considered to constitute the job titles on an environmental career ladder. This taxonomy, just as did the previous one cited, tends to define the fields as they exist today and fails to make room for newly developing jobs or a reorientation or reorganization of present tasks.

Appendix 1 includes a list of the community junior colleges, technical institutes, and other educational institutions offering or planning to offer programs in many of the fields listed in the preceding taxonomies. However, since the entire area included in the environmental considerations has been considerably broadened in the past year to include areas ranging from environmental planning to resource management and conservation, this list is by no means complete. Two other sources for additional specific curriculum offerings in colleges are the series of *Career Opportunities* books published by J. G. Ferguson Publishing Company [5] and the latest edition of *American Junior Colleges* published by the American Council on Education.[6]

It is obviously beyond the scope of a brief monograph to include a series of specific curriculums. However, there are several sources of specific curricula and curriculum guidelines. The National Environmental Health Association based in Denver, Colorado, recently prepared guidelines for a curriculum for training the general environmental health technician.

The air pollution control office of the Environmental Protection Agency has curriculum guidelines on air pollution technology cur-

ricula. The National Sanitation Foundation of Ann Arbor, Michigan, will supply an information packet on request. The packet includes specific curriculum information on curricula in environmental health technology, pollution abatement technology, water sanitation technology, environmental engineering technology, air pollution technology, water and wastewater technology, environmental sanitarian assistant, and environmental health assistant. The Water Quality Office of the Environmental Protection Agency can supply information on programs to prepare water treatment plant operators. The Office of Manpower Development and Training of the Environmental Health Service has issued *Guidelines for the Preparation of Environmental Technicians* in which general curriculum considerations are discussed. In addition, a sample curriculum in air pollution technology and an environmental technology option in chemical technology are given in detail.

The Division of Vocational-Technical Education of the U.S. Office of Education has produced or contracted for specific publications in several curricula in E.E. Included are the following which are now available:

Forestry Technology, OE-80054
Water and Wastewater Technology, OE-80057
Ornamental Horticulture Technology, OE-81017

Furthermore, similar publications are being developed in urban planning and development technology and air pollution technology. The Office of Education also has produced pamphlets on preparation of technicians for water conservation and environmental control.

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[1] Pratt, Arden L. "Cluster Core Curriculums for E.E.E." *Junior College Journal*, 41, December/January 1970-1971, No. 4, 10-12, Table 1.

[2] Pratt, Arden L. "Occupational Programs in Environmental/Ecological Education." Technician Education Yearbook 1971-72, Prakken Publications, Inc., Ann Arbor, Michigan, 1971.

[3] *An Inventory of Environmental Management Occupational Descriptions.* Arlington: Serendipity Incorporated, 1970.

[4] Fanning, Odom. *Opportunities in Environmental Careers.* New York: Universal Publishing and Distributing Corp., 1971.

[5] *Engineering Technicians.* Walter Brookings, editor. Chicago: J. G. Ferguson Publishing Co., Inc., 1969.
Health Technicians. Robert Kensinger, editor. Chicago: J. G. Ferguson Publishing Co., Inc., 1970.
Community Service and Related Specialists. Sylvia J. Bayliss, *et al*, editors. Chicago: J. G. Ferguson Publishing Co., 1969.
Agricultural, Forestry, and *Oceanography Technicians.* Howard Sidney, editor Chicago: J. G. Ferguson Publishing Co., 1969.

[6] *American Junior Colleges.* Edmund J. Gleazer, Jr., editor. Eighth edition. Washington, D. C.: American Council on Education, 1971.

XII

A Sampling of Community College Activities in Environmental Education

At this stage in the development of postsecondary environmental education a great variety of programs, methods, and objectives are in evidence. Any listing of such activities by the nature of the subject must of necessity be incomplete. Any examples of such activities may be more atypical than representative. Newer, more innovative, more effective, or more useful approaches may have replaced some of those included in a list.

In spite of all these negative statements, many find illustrative examples of activities helpful, thought provoking, and informative. In this light, the examples of E.E. are given below. To emphasize the variety, they are given randomly.

Lee Junior College at Jackson, Kentucky, has initiated a new curriculum entitled "Man and His Total Environment: Focus on Southern Appalachia." The major purpose of this new curriculum is to stimulate students to think about their heritage and the particular region in which they live. A faculty team has developed the curriculum around the five basic components. The basic unifying element of the curriculum is a series of Appalachian awareness seminars. During these seminars, specialists lecture on particular topics of concern, such as mining, pollution, overpopulation, drugs, etc., followed by a discussion period and presentation of opposing viewpoints. The second element of the curriculum is a human encounter experience. The third element is the adaptation of traditional courses to the Appalachian theme. The

IX

Manpower Planning in Environmental Education

Appearances, at least, indicate that the need for technicians, operators, and other workers in the environmental fields will be markedly increasing over the next five to fifteen years. The specific areas in which these technicians will be needed and where they will be employed is not as easily answered. Initiation of an environmental education program just because someone has initiated a similar one or, on the other hand, because no one else has initiated one similar to it, is hardly a valid reason for its offering. As was indicated repeatedly in the recent monograph by John Henderson,[1] this kind of windshield or hunch reason for initiating a program has no validity and often has led to unemployed and unemployable graduates. It also leads to waste of funds expended for equipment and capital funds for expenditures for buildings.

In spite of nationwide needs, studies published by a variety of government agencies in the past year or two and accompanying statements indicating the dire need for personnel in the various environmental fields, educators continue to ask such questions as:

What are the occupations in E.E.?

Where are the employers for the individuals prepared in E.E. programs?

Various figures for the requirements for treatment plant operators and working-level personnel in air pollution control are thrown around quite freely. A report made to Congress in 1967, denoted by No. S 49,

gave a figure in the neighborhood of 40,000 operators required by 1972. This estimation was made under the assumption that it could be supported by a direct contact sampling of municipalities and states. However, a test survey was never completed.

The Bureau of Labor Statistics, U.S. Department of Labor, has developed a comprehensive set of projections for employment and the economy of the United States by 1980. The *Occupational Outlook Handbook—1970-1971* provides detailed information for more than 700 occupations and 30 major industries. It is unfortunate, however, that the gross projections give little information on needs in various levels.

In 1970, the Environmental Health Service, later absorbed by the Environmental Protection Agency, made an analysis of available data and projected needs for environmental technicians and environmental aides or assistants in the general area described as environmental protection and pollution control.

The technicians were described as requiring two years of post-secondary education or equivalent training and experience, while the assistants or aides required some vocational training or specific job training. The deficits projected in this restudy of data were 28,000 technicians by 1975 and 39,000 by 1980. Those for aides or assistants were 31,000 by 1975 and 35,000 by 1980. Since completion of this latest study, the Environmental Protection Agency has identified the need for an additional 28,000 wastewater and sewage treatment plant operators.

While these data are indicative of a growing need in the field, other indications also point to an increasing need. The years 1970 and 1971 have seen a trend of growing determination by governmental authorities to establish and enforce more stringent environmental standards. This his culminated in the establishment of the Environmental Protection Agency. Also, growing amounts of money are being budgeted by industry for environmental purposes.

Newer environmental concerns such as solid waste management and noise control are being given more attention. There is an increasing demand on the part of government and the public to make environmental concerns part of the decision-making process. All of these trends and shifts in policy and priorities indicate that employment needs will continue to increase.

In spite of all these positive indications, we need to determine whether there are specific jobs for the graduates of specific programs. In some areas, there seem to be no trouble. In other community colleges, comments are made such as "The program is ready to begin but we are unable to identify *a single* job for a graduate."

Surveys by specific government agencies have been of very little help. Some of the manpower studies completed late in 1970 and early 1971 were, in the words of agency officials, "suspect." Much of the data was gathered from state offices, and much of it contained

"blue sky" figures or "needs." Too often the "needs" reflected "wishes" and not actual funded or fundable positions.

Some agencies are now making an effort in the direction of acquiring the needed information. The U.S. Department of Labor is in the midst of a complete study of 3,500 water treatment plants seeking specific information on jobs, levels, tasks, pay, etc. Furthermore, the Environmental Protection Agency has contracted for the preparation of a manual to assist individuals in collecting the data needed and the methods of using this data for manpower planning.

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[1] Henderson, John T. *Program Planning with Surveys in Occupational Education.* American Association of Junior Colleges, Washington, D.C.: 1970.

X

A Major Issue in Occupational Environmental Education— Core Curricula

Not only are educators asking questions about manpower needs and the like, an increasing number of questions are being asked of educators in view of the proliferation of occupational curricula in E.E. Have the various community colleges and technical institutes, which currently offer these programs and are planning curriculum expansion, made sure that the graduates of these programs will have employment opportunities in the specific fields of their preparation? Are there alternatives to the specialized training programs offered in water and wastewater technology, air pollution technology, and environmental health technology? What is, or should be, included in a program or curriculum entitled environmental technology? Is there such a thing as environmental technology?

These questions are being asked increasingly by some agencies of the federal government which, in many cases, have supported the pioneer programs in the field. Similar questions are being posed by educators and others interested in the welfare of the students.

At first glance environmental education seems to suffer from the the age-old vocational question: Is a curriculum which prepares students for a specific field more effective than a generalized offering? Although those favoring specific programs have received all available financial support from government agencies—a situation viewed by many as locking in the status quo—it is already true that some graduates have been unable to find employment in the fields for which they have been prepared. Since relatively few programs have been

offered long enough to even have graduates, this must be considered as a serious defect in program planning, and an obvious disservice to the students.

Occupational programs in E.E., however, may uniquely fit into *both* sides of the controversial issue. The shorter programs preparing operators and aides have been very successful in recruiting students and in placing graduates. Most of these have received support from the Water Quality Office of the Environmental Protection Agency or the Manpower Development and Training Office, U.S. Office of Education. On the other hand, many of the associate degree programs have fared poorly, particularly in attracting students and occasionally, as noted above, in student placement.

Dr. Mackin's earlier paper offered an alternative, the preparation of what he chooses to call the "interchangeable environmental technician." The community college workshop previously mentioned began with the basic objective of attempting to develop a list of educational experiences necessary in preparing such a technician. After completing a general task analysis, it was found that common job elements, in all levels of all job categories, in all of the environmental and ecological job clusters were rather limited. Those clearly identified as common included the basic concepts of the environment and ecology; awareness of environment and ecology and the problems pertaining to them; an awareness of environmental careers both present and those expected in the future; free employment orientation; some specific communication skills; practical computative skills; and, lastly, some specific manipulative skills. Even though this list is rather small, it does constitute a group of job elements from which a basic core of educational experiences may be developed for all occupational environmental education programs.

Additional task analysis revealed another group of job elements common to all environmental jobs in each of the two higher levels, those of the non-degree technician and those of the associate degree technician. Each of these common job elements, in turn, suggests that a core of educational experiences, in addition to the very basic core required for all three jobs' levels, could be directed toward preparing students for job entry at these two levels. Basic cores for all of the jobs at the non-degree and associate degree levels were then determined by defining unique elements required for each job level and adding them to the elements required at the job levels requiring less education for job entry.

In addition to requirements common for all job clusters, a more extensive group of common job elements was identifiable for specific groups of occupations. This led to groupings in the four job clusters presented earlier. Time available for the workshop did not permit a comprehensive task analysis; however, a list of skills and knowledge of sufficient length was compiled for each job level within each specific cluster to enable "cluster cores" of educational experiences to be out-

lined, similar to the basic cores described above. The cluster cores then consisted of common elements to be added successively as the job level required more education, just as in the development of the basic cores of job elements. The total curriculum for a specific job level in a specific job cluster would, therefore, consist of the basic core elements plus the cluster core elements appropriate to each specific job level.

The flexible character of the basic core and the specific cluster cores support the concept of a career ladder. The fact that the basic core elements are identical for each of the clusters (i.e., all environmental jobs), thus allowing facility and lateral movement, provides a basis for the "career lattice" concept. If a third element of possible movement is added through the variety of job categories—to the vertical "ladder" through the job levels, and the horizontal "lattice" movement through the job clusters—the result can be considered a three-dimensional "career matrix." A model of this concept is shown in Figure 1.

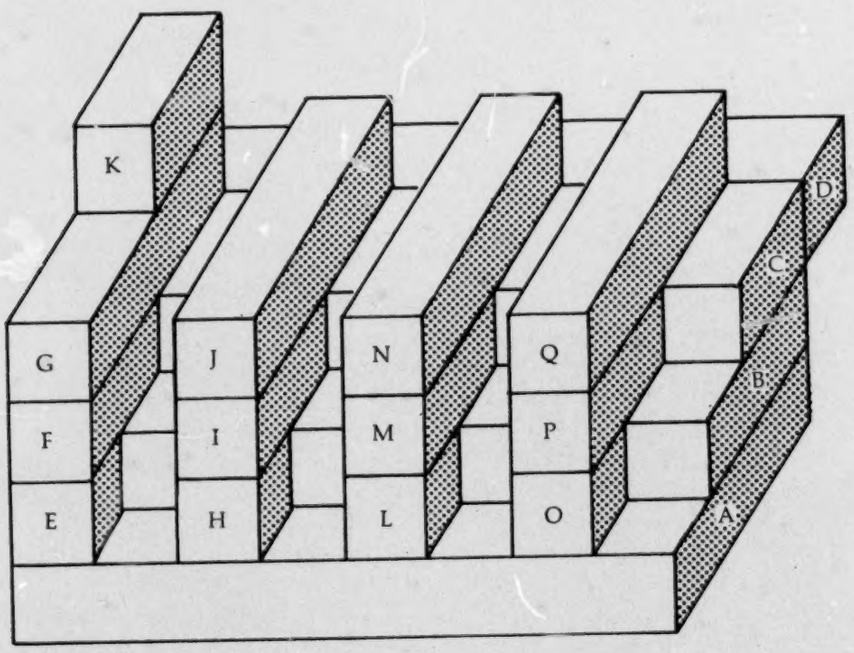

FIGURE 1
MODEL FOR CURRICULUM FOR CAREER MATRIX

Matrix Core of Education Elements

A—Basic core elements required for all job clusters and all employment levels

B—Additional core elements required for all job clusters at technician (non-degree) and technician (degree) levels

C—Additional core elements required for all job clusters at technician (degree) level

D—General education and other degree requirements, in addition to occupational core

E—Additional core elements required for all aide level jobs in the pollution prevention and control technologies job cluster

F—Additional core elements required for all technician (non-degree) jobs in the pollution prevention and control technologies job cluster

G—Additional core elements required for all technician (degree) jobs in the pollution prevention and control technologies job cluster

H, I, J—Core elements required for jobs in the disease prevention (non-patient care) technologies job cluster (the same order used in E, F, G)

K—Specific educational elements required, in addition to core elements, for preparation of occupational specialty (e.g. air pollution) at technician (degree) level

L, M, N—Core elements required for jobs in the environmental planning technologies job cluster (the same order used in E, F, G)

O, P, Q—Core elements required for jobs in the resources conservation technologies job cluster (the same order used in E, F, G)

The sections in the model diagram do not and should not be interpreted to represent courses, but, rather, modules of *varying* lengths including numbers of educational elements. As a specific example, the curriculum for the preparation of a wastewater treatment operator at a non-degree technician level would consist of the basic core elements contained in Modules A and B, the cluster core Modules E and F, and the specific Module R.

Similarly, the curriculum for the preparation of an air pollution technician (degree level) would consist of the basic core elements contained in Modules A, B, and C, the cluster core Modules E, F, and G, and the specific Module K, as well as the general education requirements contained in Module D.

There is a possibility that many educational elements contained in two or three of the cluster cores may be the same. Should this be true, smaller element modules could be prepared to further assist the student in lateral movement between the clusters. For example, some or all of Modules F and I may be identical, while differing from some or all of M and P. If these similarities are identified, a student's movement from the pollution prevention and control technologies cluster to the disease prevention technologies cluster would be made with minimum loss of time.

A concept such as this may be completely implemented only in a large community college or among a cooperating group of colleges.

However, any section of the matrix core may be selected by an individual college as the basis for program development. Most of the common elements identified in one part or another of the matrix core, while usually not long enough to constitute a course, could be used for the basis of an instruction module. In a large college or a group of cooperating colleges, these modules could be fully developed and would be available to each department or college for use in their own program areas. Such development and a common availability of the education materials thus developed would allow each institution to pick and choose from the modules, thus offering programs directly focussed on student needs and industry needs in the institution's service area. Another alternative would be to have a regional or national development of the modules included in the "career matrix" and allow program developers and those who choose materials for curriculums to build their courses and programs on selected modules.

Technical educators are often reluctant, some even resistant, to attempting or implementing a core curriculum. These same educators, however, led most others in defining the need for and application of specific objectives to their educational programs. It is apparently easier to conclude that specific objectives can be met by educational programs designed specifically for those objectives. However, in developing the "career matrix" this same concept would apply. Where a specific educational objective occurs in more than one occupational program, there is no logical reason why the same educational materials and procedures cannot be used to meet this identical objective.

Roney and Phillips in *Electromechanical Technology* have outlined a model approach to a core or "nucleate" curriculum in a variety of technologies. This approach is in operation in several community colleges and technical institutes at the present time. It has been found to work if certain conditions are present. One condition which, at this time, seems to be unnecessary is the formal preparation of the student for a certain level of "abilities" measured by the usual normative procedures. On the other hand, one condition which is absolutely imperative is that the faculty involved in using the core curriculum approach are sympathetic to the approach and are willing to enter into a cooperative educational procedure with other faculty and students—an experience apparently new to most of them.

What too many educators do not understand or do not take the time to recognize is that using a core curriculum approach does not mean sacrificing the identity of the individual occupational program, nor does it mean losing autonomy on their part. It does mean, however, that student needs and individualities must be recognized to effect the greatest possible learning. Another fact that must be recognized is that the core curriculum which we are talking of here is not the "core" which involves the courses taken by "everyone" in the college. The educational experiences included in the career matrix core are the occupational and technical needs of the student identified

from task analyses of specific occupations which are identical or very similar to educational experiences needed by students in other occupational areas also identified through task analyses. General education requirements necessitated by degree requirements, state office of education requirements for a degree, and similar requirements must be added to the curriculum.

XI

Problems and Cautions in Career Environmental Education Curricula

In view of the explosive growth of occupational Environmental Education curricula, some introspection and inspection of progress to date should be made. It is imperative at this stage in the development of E.E. that those colleges planning to enter the field step back for another look before taking the plunge. They should do this to assure themselves that they can do the job effectively.

It is clear that some of the colleges which have embarked on program offerings in this area are not delivering what they promise. Analysis by the author of the occupational programs in E.E. presently offered reveals the following weaknesses:

1. In many cases the curriculum consists of a "patchwork" of current course offerings from other curricula. In four of the colleges only one additional course dealing in any way with environmental concerns has been introduced.
2. Very few of the programs include a cooperative work experience as a part of the curriculum. On the other hand, in one college the first term in the first year consists of a cooperative experience.
3. Several programs purportedly being offered have never had students. In at least three cases the author was told that the college wanted to tie up the curriculum title, because they knew a neighboring college had planned to offer it.
4. In at least two colleges programs were started for specific tech-

nician preparation, in spite of extensive surveys indicating that no jobs were available throughout the state.

5. Hundreds of thousands of dollars have been spent in a few colleges for facilities and equipment, *before* any curriculum planning or development has taken place.

Colleges planning occupational programs in E.E. must investigate thoroughly the operative system of standards in the environmental fields in their state. Are there legal restrictions to the work of personnel, registrars, or certifying boards? What employment credentials must be recognized by an employer or by the profession? What effect do these registration and licensing procedures and requirements have on the programs? Almost everyone seems to "know" that nurses and X-ray technicians must be licensed, but too many realize only too late that sewage treatment plant operators must also be examined and licensed in many states.

Some commonly occurring problems which have arisen with occupational E.E. programs in operation during the past three or four years include the following:

1. Student recruitment
2. Placement of graduates
3. Interest of graduates
4. Employer interest
5. Practical experience for the students during the presentation of the program.

Many potential students evidence little interest or understanding of the environmental career fields. At the same time, the generally low salaries offered by health departments and other government agencies often lead students to enroll in other programs with more lucrative opportunities rather than the program of their interest.

Frequently students have entered the program as a means of transferring to a four-year college and show little interest in continuing a career as an environmental health technician or other environmental related technicians. And in many cases, local health departments and other government agencies have shown little acceptance or response to the program. In New York, for example, only four of the more than 30 departments in the state expressed any interest in hiring graduates of environmental health programs in 1970.

It appears that a cooperative program including actual on-the-job training is quite necessary in most of the environmental fields. Without this practical experience, the graduate is quite limited in what he can accomplish on the job.

fourth element is a cultural enrichment program involving the attendance of the students at a local concert series and local craft and folklore exhibits. The fifth element is a cooperative education program which includes off-campus work experience during at least one academic term.

A group of students of five colleges in New York City, including the Bronx Community College, conducted a complete ecology survey of the Bronx early in 1971. The Bronx Community College serves as a headquarters for the survey project, named Ecologicensus 1971, which also involves students from Fordham University, Manhattan College, New York University, and the College of Mt. St. Vincent. The Ecologicensus 1971 attempts to develop an environmental "report card" for every block in the Bronx, and the same is ultimately planned for each sanitation district in New York City.

Students working on the census will be given credit for field work in courses at Bronx Community College. The report card form has been standardized so that each of the individuals who are conducting the census will look for the same things and tend to react in a similar fashion with the others involved.

Community service lectures and seminars in environmental concerns have been held and are being held at many community colleges. An example of such lectures is a series held during the spring of 1971 at Delta Community College in Michigan. Included in this series, for example, was a lecture on "environics" delivered by a professor of architecture who concentrated not only on what must be done to save our environment but also on how the psychological, ecological, and physiological aspects of existence will be affected by such things as overcrowding, living in confined areas, and living beneath the ocean.

Berkshire Community College has founded an environmental studies center. The center includes an ecology museum which exhibits and portrays various habitats and ecosystems with an emphasis on the Berkshires. Native flora and fauna of both live and mounted specimens are presented in the museum. In addition, the center features an aquarium and animal cages, as well as rooms constructed to deal with the meteorological aspects of the environment.

Several community colleges have received support under Title I of the Higher Education Act of 1965 to offer community service programs dealing with such divergent topics as drug abuse, air pollution, and urban renewal. Cabrillo College in Aptos, California, is planning a program entitled Human Ecology and Environmental Planning. The core of this program is to be built on academic disciplines. There is to be no specific course such as ecology, physical geography, history, etc., although general education requirements for the associate degree will be included.

In this program, students will participate in field and community centered activities. The disciplines will be represented in the core by teachers in language, literature, mathematics, physical science, history, biology, and geography. Areas which could be included as electives

would be geology, anthropology, economics, political science, psychology, ecology, sociology, physics, and art.

Several community colleges indicated that they conduct correspondence courses in environmental studies with individuals, particularly in outlying areas of their service district. Teach-ins have been conducted during the past year or two by several community colleges with the objective of cooperative concern of students, faculty, and the public in environmental matters.

There are several instances of community and junior colleges who have entered into cooperative planning in environmental education matters with local universities, four-year colleges, and other organizations interested in education. Syracuse University has been the center of a recent thrust in this direction by a group of universities and community colleges in central New York. The principal objective of this group is to develop a program of environmental communication for educational television as a community service. The Association of Independent Colleges and Universities of Michigan recently received a Kellogg Foundation grant to underwrite several seminars on environmental concerns in 1971.

Community colleges and technical institutes in growing numbers are operating ecological or environmental field stations, either individually for the local community or as a part of a regional or statewide network. Central Arizona College, for example, will operate a special recording and research station for the county. New Jersey's Union College is planning to do the same as a unit of a state network of such stations. And Triton College in Illinois operates what it terms a pollution monitoring service.

At California's College of the Siskiyous, two semester courses in E.E. were instituted last year. One semester dealt only with rules and standards. The second considered applications of these standards. In the words of officials of the college, this was a wrong approach; all facets will now be considered together.

At El Camino College, a group called the Green Earth Club have organized a multi-disciplinary curriculum which they have named the "Green Earth Movement."

At Columbia-Green Community College in New York, a variety of field projects for students are sponsored by the Columbia County Department of Health. The students are operating air surveillance stations and pollen stations throughout the county. Furthermore, the students make surveys to determine the normal flora and fauna and the impact of people upon the strains. Other students carry out analyses for dissolved oxygen, in addition to filter and other tests on sewage and waste treatment discharges. During the summer season, the students conduct water analyses at the bathing beaches. Columbia-Green Community College also conducts a summer program in environmental studies. The program includes regular students of the community college, part-time students of the college, area high school

teachers, selected high school students, and area elementary and junior high school students.

The Health Planning Council of the Jacksonville Area, Inc., represents a wide spectrum of individuals interested in environmental health matters. Included in the planning council, as well as the community college and other members of the educational community, are professionals, consumers, local government representatives, ethnic minorities, and civic and business interests. The production of health manpower for the area is one of the greatest concerns for the group at the present time.

Morehead State University at Morehead, Kentucky, has been conducting a comprehensive teach-in for science teachers both in the social science and physical science areas. The teach-in has been considering all manner of environmental problems.

The Monroe County Community College in Michigan has received support from the Rockefeller Foundation and the Esso Foundation for community service development in the area of environmental matters.

At a representative California junior college, each freshman student enrolled in the general education E.E. course participates in a project. The following are examples of projects which the students participated in during 1970-1971.

1. Color-slide photography for the theology of nature
2. Drug abuse
3. Ecotactics
4. Coast legislation
5. Zero population growth
6. California water quality control board
7. County agricultural zoning
8. General city plan-growth controls
9. Water pollution surveillance
10. County sewage disposal and treatment
11. Genetic counseling
12. Solid waste disposal
13. Litter cleanup campaign
14. Noise pollution
15. Agricultural and industrial air pollution-monitoring
16. Fuel engine air pollution
17. County government
18. Soil and water conservation, local flood control
19. Announce meeting times, attend and report on city and county planning commission meetings
20. Family planning
21. City or county recreational and parks department
22. Handicapped children
23. Environmental center
24. Scenic highways vs. unplanned freeways

25. Electric power production
26. River aqueduct
27. Alcoholism
28. County trails
29. Forestry practices
30. Fish and game problems
31. Family service agency
32. Pollution trail
33. Housing in county (environmental aspects)
34. Water testing
35. People scrapbook or slide collection
36. Ecological survey of succession in an aquarium
37. Car or bicycle or walk pools for junior college
38. Help Earth Day
39. Keep a chart of politicians' statements and actions
40. Support a conservation organization
41. Start a conservation (ecology) club on campus

Jackson Community College in Michigan operates a Center for Environmental Studies. Among other activities, the Center conducts chemical and biological analyses of local water sources, distributing the information to schools and interested community groups.

Day-long workshops considering environmental concerns are held at Minnesota's Anoka Ramsey State Junior College. The workshops involve administration, faculty, and students, including those from elementary and secondary schools.

At Marymount College in Florida several E.E. activities are underway. A course is being offered which is described as a "creative encounter with nature." The course is a "solid one with transferable credit." In addition, the college has infused environmental considerations into all its biology courses and supports an elaborate Earth Day.

The River is an individual studies program offered by Wilbur Wright College in Chicago. The program is an ecosystem analysis of the Des Plaines River in Cook County. All students in the college are eligible to enroll in the program, with no special background needed or required. In the program, ecological testing is designed and conducted. After an oral presentation of their findings, conclusions are formulated concerning the influence of urban life on the river.

Willmar State Junior College in Minnesota has established a natural history area, in support of their course in conservation of natural resources. The college cooperates in projects with local sportsmen's clubs, the soil conservation district, and the area game management personnel.

An announcement of another Minnesota junior college states that it has set aside 50 acres to be *developed* into a natural state park. It would seem more appropriate if it were to be *undeveloped.*

XIII

Reprise Environmental Education

In the opinion of most educators attending the AAJC-N.S.F. Conference on Environmental Education in Washington in May 1971, several cautions were enumerated for all undergraduate programs or courses in environmental education.

1. It is virtually impossible to get a message across by simply stating facts. To be effective, the facts must be given a personal significance and, if possible, augmented by some sort of personal involvement.
2. The "doomsday" approach is of little educational value.
3. A positive approach must be taken when solutions are proposed. Again, a measure of personal involvement can reinforce the educational experience.
4. It is completely ineffective to talk need for change to students and not change the institution in its own approach to pollution and leadership in environmental matters. This is a sure way to introduce a "credibility gap."
5. An educational institution should offer more than a single E.E. course. While a course is substantially better than nothing, a year's experience would be better. Best of all, however, would be the injection or infusion of environmental and ecological concerns into all elements of the college—educational programs, operations, on-campus activities, and community relations.
6. E.E. must break out of the shell of cognitive skills and assist in

the development of synthesis and judgment, which, in turn, can assist in the ability and confidence needed for decision making.

7. Attempting to fit E.E. experiences into the inflexible mold of a 50-minute period—3 periods a week, 16 weeks a semester—is a straight-jacket alien to the principles encountered in environmental considerations.
8. Any course material designed and packaged as a unit should be structured to be used in total or in part, enabling the teacher to augment with his own materials.
9. To effectively initiate E.E. into the curriculum at any educational level, there must be a vast teacher training thrust. As yet no good model has emerged. When it does, the problem will be the procurement of the funds necessary for preparation of materials and training the teachers. Reorientation of supervisory and administrative personnel will also be necessary if the effort is to be most effective and successful.

Appendix 1

Occupational Curricula in Environmental Education

The curricula listed in this table lead to a two-year associate degree with exceptions noted.

1. "No degree" indicates that the curriculum is probably one-year in length leading to a certificate.
2. "M.D.T.A." indicates that it is a curriculum of one-year or less, funded under the Manpower Development Training Act.
3. "(Technicians)" indicates that no final decision had been made as to the specific title or objectives of the curriculum.
4. Program status
   a. "C" indicates the program was offered during 1970-71.
   b. "P-71" indicates the program is planned to begin during 1971-72.
   c. "P-72" indicates the program is planned to begin during 1972-73.
   d. "P-3" indicates the program is planned to begin during the period of 1971-73.
   e. "W" indicates that the program is under active consideration.
5. Curricula with the following titles are not included in the tabular listing:

Air conditioning, heating, and refrigeration technology
Arboriculture technology
Auto tune-up and instrumentation
Citrus fruits, production, science
Community development
Community service aides
Crop production
Farm management
Fire prevention and protection
Floriculture
Forest conservation
Forestry management
Forestry technology
Health services management
Highway engineering technology
Highway traffic engineering technology

Home and community service
Irrigation technology
Landscape development technology
Land use technology
Mining technology
Nuclear technology
Ornamental horticulture
Park management
Public service assistant
Range management
Recreation management and leadership
Rehabilitation assistant
Soil reclamation and conservation technology
Transportation and safety specialist
Turfgrass management technology
Vitaculture technology
Wildlife and game management

Educational Institution	*Occupational Curriculum Title*	*Program Status*
ALABAMA		
Enterprise State Junior College Enterprise, Alabama	(Technicians)	W
Jefferson State Junior College Birmingham, Alabama	Urban development and planning technology	C
Mobile State Junior College Mobile, Alabama	Environmental technology	P-71
Northeast Alabama State Junior College Rainsville, Alabama	Water treatment technology	P-71
Northwest Alabama State Junior College Phil Campbell, Alabama	(Technicians)	W
Patrick Henry State Junior College Monroeville, Alabama	Water and wastewater technology	W
ALASKA		
Juneau-Douglas Community College Juneau, Alaska	Marine biology and oceanography	C
University of Alaska Department of Land Resources College, Alaska	Conservation technicians	C
ARIZONA		
Central Arizona College Coolidge, Arizona	(Technicians)	W
Phoenix College Phoenix, Arizona	Environmental technology (chemistry and engineering options)	P-71
Pima College Tucson, Arizona	Environmental technology (no degree)	P-3
ARKANSAS		
Southwest Technical Institute East Camden, Arkansas	Sewage plant operators (M.D.T.A.)	C

CALIFORNIA

American River College Sacramento, California	Natural resources	W
Antelope Valley College Lancaster, California	Natural resource management	C
Bakersfield College Bakersfield, California	Geologic technology	C
Butte College Durham, California	Natural resources conservation	C
Cabrillo College Aptos, California	Marine biology and oceanography	C
Cañada College Redwood City, California	Environmental technology	W
Cerritos College Norwalk, California	Environmental technology	P-3
Chaffey College Alta Loma, California	Environmental technician	P-71
City College of San Francisco San Francisco, California	(Technicians)	W
College of Marin Kentfield, California	Environmental health technology	C
	Marine technology	C
College of the Redwoods Eureka, California	Commercial fisheries	C
	Environmental health technology	C
Columbia Junior College Columbia, California	Natural resources conservation technicians	C
	Park management technology	C
	Oceanography technicians	C
Compton Community College Compton, California	Environmental technology	P-3
	Water and wastewater technology	P-3
Contra Costa College San Pablo, California	Environmental control technician	C
	Environmental health sciences	C
	Urban planning technology	C
Cuesta College San Luis Obispo, California	(Technicians)	W
Cypress College Cypress, California	Environmental technology	P-3
Diablo Valley College Pleasant Hill, California	Water and sanitation technicians	W
East Los Angeles College Los Angeles, California	Urban development and planning technology	C
El Camino College Torrance, California	"Interchangeable" environmental technicians	W
	Marine technicians	P-3
Feather River College Quincy, California	Fish and wildlife technology	C
Fullerton Junior College Fullerton, California	Oceanographic technology	C
Gavilan College Gilroy, California	Environmental technology	P-3

Golden West College Huntington Beach, California	Environmental technology	P-72
	Urban development and planning technology	P-72
Hartnell College Salinas, California	Oceanography technicians	C
Imperial Valley College Imperial, California	Environmental technology	P-3
Los Angeles City College Los Angeles, California	Air pollution technology	W
Los Angeles Harbor College Wilmington, California	(Technicians)	P-72
Los Angeles Pierce College Los Angeles, California	Natural resource management	C
Los Angeles Trade Technical College Los Angeles, California	Environmental technology (no degree; certified)	C
	Oceanography technicians	P-3
Marymount College of Palos Verdes Palos Verdes Peninsula, California	Marine biology and oceanography	P-3
Modesto Junior College Modesto, California	Environmental technology	W
Moorpark College Moorpark, California	Environmental technology (no degree)	P-3
Napa College Napa, California	Environmental technology (no degree)	P-3
Ohlone College Fremont, California	Environmental technology	C
Orange Coast College Costa Mesa, California	Air pollution control technician (M.D.T.A.)	C
	Conservation technology	C
	Environmental/ecological resource specialist (M.D.T.A.)	C
	Environmental quality control aide (M.D.T.A.)	C
	Environmental technology	C
	Sewage plant operators (no degree)	C
	Wastewater treatment plant operators (M.D.T.A.)	C
Palomar Community College San Marcos, California	Environmental technology (no degree)	P-3
	Marine biology technicians	P-3
Rio Hondo College Whittier, California	Environmental technology	W
Sacramento City College Sacramento, California	Wastewater treatment plant operators (no degree)	C
Saddleback College Mission Viejo, California	Oceanography and marine biology technicians	C
San Diego Community Colleges San Diego, California	Environmental health technology	W
	Health and safety technology	C

	Marine technology	C
	Water and wastewater technology	W
Santa Ana College Santa Ana, California	Environmental technology	C
	Marine biology	C
	Oceanography	P-3
Santa Barbara City College Santa Barbara, California	Environmental technology	P-3
	Marine diving technology	C
	Marine instrumentation technology	C
	Oceanography	P-3
Shasta College Redding, California	Water and wastewater technicians (no degree)	P-3
Southwestern College Chula Vista, California	Marine biology (no degree)	C
	Environmental technician	P-3
Ventura College Ventura, California	Environmental technology (no degree)	C
West Valley College Campbell, California	Environmental technology	P-3
	Conservation technology	C
Yuba College Marysville, California	Pest control technicians (M.D.T.A.)	C
COLORADO		
Aims Community College Greeley, Colorado	Environmental technology	W
	Sewage plant operation and control (no degree)	C
	Water and wastewater technology	W
Arapahoe Junior College Littleton, Colorado	Environmental health technology	W
Colorado Mountain College Glenwood Springs, Colorado	Natural resources conservation (no degree)	C
	Environmental technology	P-3
Community College of Denver Denver, Colorado	Environmental control technology	P-71
El Paso Community College Colorado Springs, Colorado	(Technicians)	W
Mesa College Grand Junction, Colorado	Environmental technology	P-71
	Geologic technology	C
CONNECTICUT		
Greater Hartford Community College Hartford, Connecticut	Environmental health technology	P-71
Hartford State Technical College Hartford, Connecticut	Environmental technology	P-72
Housatonic Community College Stratford, Connecticut	Marine biology	P-3
	Urban professional assistant	C
Junior College of Connecticut Bridgeport, Connecticut	(Technicians)	W
Mattatuck Community College Waterbury, Connecticut	Environmental technology	W

Middlesex Community College Middletown, Connecticut	Environmental technology (no degree)	P-3
	Oceanography	P-3
Norwalk Community College Norwalk, Connecticut	Environmental technology	W
Norwalk State Technical College Norwalk, Connecticut	(Technicians)	P-71
Northwestern Connecticut Community College Winsted, Connecticut	Environmental technology (no degree)	P-3
Thomas Valley State Technical College Norwich, Connecticut	Environmental technology	P-72

DELAWARE

Delaware Technical and Community College Dover, Delaware	Environmental technology	P-3
	Oceanography	P-3
Delaware Technical and Community College Georgetown, Delaware	Marine technology	P-3
Delaware Technical and Community College Wilmington, Delaware	Environmental engineering technology	P-71

DISTRICT OF COLUMBIA

Washington Technical Institute Washington, D. C.	Environmental science technology	C
	Water pollution technology	C

FLORIDA

Brevard Junior College Cocoa, Florida	Environmental control engineering technician	C
Broward Junior College Fort Lauderdale, Florida	Environmental pollution technicians	P-71
Central Florida Junior College Ocala, Florida	Radiological health technology	C
Florida Junior College Jacksonville, Florida	Environmental technology	P-3
	Marine biology	P-3
Florida Keys Junior College Key West, Florida	Aquaculture technology	P-71
Gulf Coast Junior College Panama City, Florida	Marine biology	C
Hillsborough Junior College Tampa, Florida	Urban development and planning technology	C
Jones College Jacksonville, Florida	Marine biology	C
Lake City Community College Lake City, Florida	Environmental technology	P-3

Miami-Dade Junior College Miami, Florida	Marine survey technology Construction engineering aide (env.) (M.D.T.A.) Environment control technology Environmental engineering aide (M.D.T.A.) Environmental engineering technician (no degree)	C C W C C
Oklaloosa-Walton Junior College Niceville, Florida	Marine biology Water and wastewater technology	P-3 P-3
Palm Beach Junior College Lake Worth, Florida	Air pollution technology Water treatment and sanitation technology	P-71 C
St. John's River Junior College Palatka, Florida	Environmental engineering technology	C
St. Petersburg Junior College St. Petersburg, Florida	Water and wastewater technology	P-71
Santa Fe Junior College Gainesville, Florida	Air pollution technology Environmental technology	C P-3
Webber College Babson Park, Florida	Environmental technology	P-3
GEORGIA		
Abraham Baldwin Agricultural College Tifton, Georgia	Conservation technicians Environmental technicians	W W
Atlanta Area Vocational-Technical School Atlanta, Georgia	Sanitary engineering technology	C
DeKalb College Clarkston, Georgia	Environmental technology	P-3
Gordon Military College Barnesville, Georgia	(Technicians)	W
Kennesaw Junior College Marietta, Georgia	(Technicians)	W
Middle Georgia College Cochran, Georgia	(Technicians)	W
South Georgia College Douglas, Georgia	Urban development and planning technology	C
HAWAII		
Leeward Community College Pearl City, Hawaii	Environmental technology Marine biology and oceanography	C C
Maui Community College Kahului, Maui, Hawaii	Oceanography	P-3
ILLINOIS		
Belleville Area College Belleville, Illinois	Environmental technology (no degree)	P-3

Black Hawk College Moline, Illinois	(Technicians)	W
Carl Sandburg College Galesburg, Illinois	Environmental technology (no degree)	C
Central Y.M.C.A. Community College Chicago, Illinois	Environmental technology	P-3
College of DuPage Glen Ellyn, Illinois	Environmental health technology	C
	Marine biology and oceanography	P-3
College of Lake County Grayslake, Illinois	Environmental technology	P-3
East St. Louis Community College East St. Louis, Illinois	Environmental laboratory assistant (M.D.T.A.)	C
Elgin Community College Elgin, Illinois	Environmental technology	P-3
Highland Community College Freeport, Illinois	Water and sanitation technology	P-70
Illinois Eastern Junior College Olney, Illinois	Environmental technology	P-3
John A. Logan Community College Carterville, Illinois	Environmental technology	P-3
Kaskaskia College Centralia, Illinois	Environmental technology	P-3
Lewis and Clark Community College Godfrey, Illinois	Environmental technology	P-3
Malcolm X College Chicago, Illinois	Community health assistant	C
McHenry County College Crystal Lake, Illinois	Environmental technology	P-71
Morton College Cicero, Illinois	Environmental technology (no degree)	P-3
Olive-Hardy College Chicago, Illinois	Environmental control technology	C
Parkland College Champaign, Illinois	Environmental technology	P-3
Prairie State College Chicago Heights, Illinois	Water and sanitation technicians	W
Robert Morris College Carthage, Illinois	Environmental technology	W
Southern Illinois University Vocational-Technical Institute Carbondale, Illinois	Water resources technology	C
Southwest College Chicago, Illinois	Environmental technology	P-73

Triton College River Grove, Illinois	(Technicians)	W
Waubonsee Community College Sugar Grove, Illinois	Wastewater technology	C
Wilbur Wright College Chicago, Illinois	(Technicians)	W
William Rainey Harper College Palatine, Illinois	(Technicians)	P-72
INDIANA		
Indiana Vocational Technical College Indianapolis, Indiana	Environmental health technology	C
Indiana Vocational Technical College Indianapolis, Indiana	Environmental health technology	C
Indiana Vocational Technical College Kokomo, Indiana	(Technicians)	P-71
Indiana Vocational Technical College Lafayette, Indiana	Environmental control technology	C
Indiana Vocational Technical College South Bend, Indiana	Water and wastewater technology	C
Indiana Vocational Technical College Terra Haute, Indiana	Air pollution technology Water-sanitation technology Environmental control technology (planned)	P-72 P-72 P-72
Mallory Technical Institute	Sewage plant treatment technicians (M.D.T.A.)	C
Northwest Technical Institute Gary, Indiana	Wastewater treatment specialist (no degree)	C
Purdue University, School of Technology Lafayette, Indiana	Pollution control technology	C
Wabash Valley Technical Institute Terra Haute, Indiana	Air pollution and water treatment	P-72
IOWA		
Des Moines Area Community College Ankeny, Iowa	Environmental control technology	P-71
Indian Hills Community College Ottumwa, Iowa	Air pollution technicians Conservation technicians	W W
Iowa Lakes Community College Estherville, Iowa	Environmental technology Marine biology	P-3 P-3
Iowa Western Community College Council Bluffs, Iowa	Environmental technology	P-3

Kirkwood Community College Cedar Rapids, Iowa	Environmental health assistant (no degree) Wastewater and treatment plant operator (M.D.T.A.) Health and environmental aide (M.D.T.A.)	C C C
Western Iowa Technical College Sioux City, Iowa	Environmental technology	P-3
KANSAS		
Garden City Community College Garden City, Kansas	Environmental studies (pollution control)	W
Johnson County Community College Shawnee Mission, Kansas	Environmental technology	W
KENTUCKY		
Henderson Community College Henderson, Kentucky	Community health assistant	P-3
Hopkinsville Community College Hopkinsville, Kentucky	Environmental technology	P-3
Jefferson Community College Louisville, Kentucky	Environmental technology	P-3
Lexington Technical Institute Lexington, Kentucky	(Technicians)	W
Richmond Community College Richmond, Kentucky	Environmental health technology	P-72
Somerset Community College Somerset, Kentucky	Environmental technology Conservation technology	W W
LOUISIANA		
Delgado College New Orleans, Louisiana	(Technicians)	P-72
MAINE		
Eastern Maine Vocational Technical Institute Bangor, Maine	Water and wastewater technology	P-71
Southern Maine Vocational Technical Institute South Portland, Maine	Applied marine biology and oceanography Marine science technology Wastewater technology	C C C
MARYLAND		
Allegany Community College Cumberland, Maryland	Environmental technology Sanitation technology	P-3 P-3
Anne Arundel Community College Arnold, Maryland	Environmental technology Ocean engineering technology Wildlife technology	P-3 P-3 W

Baltimore Junior College Baltimore, Maryland	Environmental community planning and development technology	C
	Environmental science	C
Catonsville Community College Baltimore, Maryland	Environmental technology	P-3
Charles County Community College La Plata, Maryland	Estuarine resources technology	P-72
	Pollution abatement technology	C
	Solid waste technology and operator training (no degree)	C
Chesapeake College Wye Mills, Maryland	Environmental health technology	C
	Marine biology	P-3
Community College of Baltimore Baltimore, Maryland	Environmental technology	P-71
	Urban development and planning technology	C
Essex Community College Baltimore County, Maryland	Urban development and planning technology	C
	(Technicians)	W
Frederick Community College Frederick, Maryland	Environmental control and measurement technician	P-72
Hagerstown Junior College Hagerstown, Maryland	(Technicians)	P-71
Harford Junior College Bel Air, Maryland	Environmental technology	P-3
Howard Community College Columbia, Maryland	Environmental technology	P-3
Montgomery College Takoma Park, Maryland	Radiation science	C
	Urban development and planning technology	C
Prince George's Community College Largo, Maryland	Marine biology	P-3
	Environmental technology	P-3
Villa Julie College Stevenson, Maryland	Community health assistant	P-3
MASSACHUSETTS		
Berkshire Community College Pittsfield, Massachusetts	Environmental technology	C
	Environmental technician (M.D.T.A.)	C
Bradford Junior College Bradford, Massachusetts	(Technicians)	W
Bristol Community College Fall River, Massachusetts	Environmental technology	W
	Oceanography	P-3
	Water treatment inspector (M.D.T.A.)	C
Endicott Junior College Beverly, Massachusetts	Urban development and planning technology	C
Greenfield Community College Greenfield, Massachusetts	Environmental science	W
Holyoke Community College Holyoke, Massachusetts	Environmental science technology	P-71

Massasoit Community College West Bridgewater, Massachusetts	Marine biology	P-3
New England Institute Boston, Massachusetts	Environmental technology	C
North Shore Community College Beverly, Massachusetts	Public environmental health technology	C
	Radiologic technology	C
Quinsigamond Community College Worcester, Massachusetts	Air pollution technology	P-71
	Environmental health technology	C
	Water treatment and sanitation technology	P-71
Springfield Technical Community College Springfield, Massachusetts	Air quality technician	P-71
	Waste treatment plant operators	P-71
	Water quality technician	P-71
Wentworth Technical Institute Boston, Massachusetts	Environmental technology	P-3
Worcester Junior College Worcester, Massachusetts	Oceanography	C
	(Technicians)	W

MICHIGAN

Alpena Community College Alpena, Michigan	Solid waste disposal technicians (M.D.T.A.)	C
	Water quality technology	P-71
Bay de Noc Community College Escanaba, Michigan	Radiologic technicians (M.D.T.A.)	C
	Water purification technology	C
Ferris State College Big Rapids, Michigan	Environmental sanitarian assistant	C
	Pesticide technology	C
Genesee Community College Flint, Michigan	Environmental control technology (Air pollution specialty)	
Henry Ford Community College Dearborn, Michigan	Environmental technology	P-71
Jackson Community College Jackson, Michigan	Environmental technology	W
Kalamazoo Valley Community College Kalamazoo, Michigan	Environmental technology	C
Kirtland Community College Roscommon, Michigan	General aide program (in Natural Resources Department)	C
Lansing Community College Lansing, Michigan	Civil technology (sanitary engineering option)	C
	Environmental technology	P-3
Monroe County Community College Monroe, Michigan	Environmental control technology	C
Northwestern Michigan College Traverse City, Michigan	Marine biology	P-3
	Waste disposal technology	P-72
Oakland Community College Bloomfield Hills, Michigan	Environmental technology	W

Schoolcraft College Livonia, Michigan	(Technicians)	W
Southwestern Michigan College Dowagiac, Michigan	Waste disposal technology Water treatment technology	P-72 P-72
University of Michigan Ann Arbor, Michigan	Environmental health technology	C
Washtenaw Community College Ann Arbor, Michigan	Water and wastewater technology (no degree; certified) Environmental technology	C P-3
Wayne County Community College Detroit, Michigan	Air pollution and vehicle emissions technology Environmental health and sanitation technology Urban development and planning technology Water and wastewater technology	P-71 P-71 C P-71

MINNESOTA

Austin State Junior College Austin, Minnesota	Conservation technicians	W
Brainerd Area Vocational-Technical School Brainerd, Minnesota	Natural resource management	C
Hibbing State Junior College Hibbing, Minnesota	Environmental technology Oceanography	P-3 P-3
Itasca State Junior College Grand Rapids, Minnesota	Environmental technology	W
Lakewood State Junior College White Bear Lake, Minnesota	Environmental control technology	P-71
North Hennepin State Junior College Minneapolis, Minnesota	Urban development and planning technology	C
Northland State Junior College Thief River Falls, Minnesota	(Technicians)	W
St. Cloud Area Vocational-Technical School St. Cloud, Minnesota	Water and wastewater technology	C
Vermillion State Junior College Ely, Minnesota	Water and wastewater technology	P-3

MISSISSIPPI

Hinds Junior College Raymond, Mississippi	(Technicians)	P-72
Mississippi Gulf Coast Junior College Jefferson Davis Campus Gulfport, Mississippi	(Technicians)	W

MISSOURI		
Crowder College Neosho, Missouri	(Technicians)	W
East Central Junior College Union, Missouri	Environmental technology	P-3
Forest Park Community College St. Louis, Missouri	Pollution abatement technicians	P-3
Maple Woods Community College Kansas City, Missouri	Water treatment and sanitation technology	C
Meramec Community College St. Louis, Missouri	Pollution abatement technology (water and wastewater option)	W
Mineral Area College Flat River, Missouri	Health and safety technology	P-3
Missouri Southern College Joplin, Missouri	Environmental technology	P-3
Penn Valley Community College Kansas City, Missouri	Water and wastewater treatment plant operator	P-71
Water and Wastewater Technical School St. Louis, Missouri	Water and wastewater technology	C
NEBRASKA		
Lincoln Technical College Lincoln, Nebraska	Environmental technology (air and water concentration)	P-72
NEW JERSEY		
Atlantic Community College Mays Landing, New Jersey	Water and wastewater treatment technology	C
Bergen Community College Paramus, New Jersey	(Technicians)	W
Brookdale Community College Lincroft, New Jersey	Environmental technology	P-3
Camden County Vocational-Technical School Blackwood, New Jersey	Environmental health technology	C
County College of Morris Dover, New Jersey	Water and wastewater technology (no degree)	C
	Environmental technology	P-3
Cumberland County College Vineland, New Jersey	Urban development and planning technology	P-3
Essex County College Newark, New Jersey	(Technicians)	W
Middlesex County College Edison, New Jersey	Environmental technology	P-3
Ocean County College Toms River, New Jersey	(Technicians)	W
Warren County Technical Institute Washington, New Jersey	Environmental health technology	C

NEW YORK

Adirondack Community College Glens Falls, New York	(Technicians)	P-72
Borough of Manhattan Community College New York, New York	Urban development and planning technology	C
Broome Technical Community College Binghamton, New York	Environmental health technology	C
Community College of the Finger Lakes Canandaigua, New York	Environmental technology	W
Corning Community College Corning, New York	Environmental technology	W
Dutchess Community College Poughkeepsie, New York	Natural resources conservation technology	P-71
Erie Community College Buffalo, New York	Environmental technology	P-71
Genesee Community College Batavia, New York	Environmental management	P-3
Hudson Valley Community College Troy, New York	Environmental technology Radiological technology	C C
Kingsborough Community College Brooklyn, New York	Environmental technology Marine technology	P-71 P-71
Monroe Community College Rochester, New York	Environmental technology	P-3
Niagara County Community College Niagara Falls, New York	Environmental technology	P-3
North Country Community College Saranac Lake, New York	Environmental technology	P-3
Onondaga Community College Syracuse, New York	Environmental technology	P-3
Queensborough Community College Bayside, New York	Environmental health technology	C
Schenectady Community College Schenectady, New York	(Technicians)	W
State University of New York Agricultural and Technical College Alfred, New York	Air pollution and basic ecology	P-71
State University of New York Agricultural and Technical College Canton, New York	Milk and food sanitarians	C

State University of New York Cobleskill, New York	Environmental technology Fisheries and wildlife technology	P-3 C
State University of New York Delhi, New York	Urban development and planning technology Environmental health technology Environmental science technology	C P-71 P-71
State University of New York Agriculture and Technical College Farmingdale, New York	Environmental technology Natural resource management	P-71 P-71
State University of New York Agricultural and Technical College Morrisville, New York	Environmental sciences (water and wastewater) Natural resources conservation Public health technology	C C C
Staten Island Community College Staten Island, New York	Environmental health technology	C
Suffolk County Community College Selden, New York	Environmental technology Marine technology	P-3 C
Sullivan County Community College South Fallsburg, New York	Water and air pollution technology	C
Tompkins-Cortland Community College Groton, New York	Environmental technology	P-3
Ulster Community College Stone Ridge, New York	Environmental technology	P-3
Voorhees Technical Institute New York, New York	Urban development and planning technology	C

NORTH CAROLINA

Beaufort County Technical Institute Washington, North Carolina	Environmental technology	P-3
Caldwell Technical Institute Lenoir, North Carolina	(Technicians)	W
Cape Fear Technical Institute Wilmington, North Carolina	Marine technology	C
Carteret Technical Institute Morehead City, North Carolina	Marine biology and oceanography Fisheries and wildlife technology	C P-3
Catawba Valley Technical Institute Hickory, North Carolina	Park management	C
College of the Albemarle Elizabeth City, North Carolina	Environmental technology	P-3
Davidson County Community College Lexington, North Carolina	(Technicians)	W

Fayetteville Technical Institute Fayetteville, North Carolina	Environmental engineering technology	C
Guilford Technical Institute Jamestown, North Carolina	Air pollution and waste disposal technicians	W
Haywood Technical Institute Clyde, North Carolina	Fish and wildlife technicians	C
	Water and sanitation technicians	W
Kittrell Junior College Kittrell, North Carolina	(Technicians)	W
Lenoir Community College Kinston, North Carolina	Fisheries research technicians	C
Martin Technical Institute Williamston, North Carolina	(Technicians)	P-71
Pitt Technical Institute Greenville, North Carolina	Water and air pollution technicians	P-72
Rowan Technical Institute Salisbury, North Carolina	(Technicians)	W
Southeastern Community College Whiteville, North Carolina	Environmental technicians	P-71
Southwestern Technical Institute Sylva, North Carolina	(Technicians)	P-71
Vance County Technical Institute Henderson, North Carolina	Environmental technology	P-3
Wayne Community College Goldsboro, North Carolina	(Technicians)	W
NORTH DAKOTA		
North Dakota State School of Science Wahpeton, North Dakota	Environmental technology	C
OHIO		
Clark County Technical Institute Springfield, Ohio	Water and wastewater technology	C
Columbus Technical Institute Columbus, Ohio	Environmental technology	W
	Water treatment operator (M.D.T.A.)	C
Cuyahoga Community College District Cleveland, Ohio	Urban development and planning technology	P-71
Jefferson County Technical Institute Steubenville, Ohio	(Technicians)	W
Lakeland Community College Mentor, Ohio	Water and wastewater technology	P-3
Muskingum Area Technical Institute Zanesville, Ohio	Natural resources technology	C
	Water pollution control technology	C

Ohio College of Applied Science Portsmouth, Ohio	(Technicians)	P-72
Ohio University Portsmouth Campus Portsmouth, Ohio	(Technicians)	W
Penta Technical College Perrysburg, Ohio	Environmental health technology	C
Tri-County Technical Institute Nelsonville, Ohio	Environmental health technology	C
University of Toledo Community and Technical College Toledo, Ohio	Environmental and public health technology Water pollution control	C C
Vanguard Technical Institute Fremont, Ohio	(Technicians)	P-3

OKLAHOMA

Connors State College Warner, Oklahoma	(Technicians)	P-3
Northern Oklahoma College Tonkawa, Oklahoma	Environmental technology	P-71
Oklahoma State University Technical Institute Stillwater, Oklahoma	Radiological health technology Water and sewage plant operator (M.D.T.A.)	C C
Seminole Junior College Seminole, Oklahoma	Water and wastewater technology	C

OREGON

Clackamas Community College Oregon City, Oregon	Marine technology Oceanographic technician Water sanitation technology	C C C
Lane Community College Eugene, Oregon	Environmental technology (Water pollution control) (Air pollution option)	P-71 P-71
Linn Benton Community College Albany, Oregon	Environmental technology Sewage treatment plant operator (M.D.T.A.)	C C
Mt. Hood Community College Gresham, Oregon	Environmental technology	P-3
Oregon Technical Institute Klamath Falls, Oregon	Air pollution technology Environmental health technology Water and wastewater technology	C C C
Portland Community College Portland, Oregon	Environmental technology Marine biology and oceanography	P-3 P-3
Southwestern Oregon Community College Coos Bay, Oregon	Oceanography and marine biology	P-3

PENNSYLVANIA		
Community College of Allegheny County Pittsburgh, Pennsylvania	Environmental health technology Environmental technology	C P-3
Community College of Philadelphia Philadelphia, Pennsylvania	Environmental technicians Urban development and planning technology	W W
Pennsylvania State University Berks Campus University Park, Pennsylvania	Air pollution technology Urban development and planning technology (no degree)	C C
Pennsylvania State University Wilkes-Barre Campus Wilkes-Barre, Pennsylvania	Environmental technology	P-3
Williamsport Area Community College Williamsport, Pennsylvania	Environmental technology	P-3
RHODE ISLAND		
Roger Williams College Providence, Rhode Island	(Technicians)	W
University of Rhode Island Providence, Rhode Island	Commercial fisheries	C
SOUTH CAROLINA		
Greenville Technical Education Center Greenville, South Carolina	Environmental science technology	C
Piedmont Technical Education Center Greenwood, South Carolina	Environmental health technology	W
Sumter Area Technical College Sumter, South Carolina	Environmental health engineering technology	C
TENNESSEE		
Chattanooga State Technical Institute Chattanooga, Tennessee	Environmental technology Marine biology and oceanography	P-71 P-3
Cleveland State Community College Cleveland, Tennessee	Environmental technology	P-3
Motlow State Community College Tullahoma, Tennessee	Environmental technology	P-71
State Technical Institute at Memphis Memphis, Tennessee	Environmental technology	P-3
TEXAS		
Brazosport Junior College Freeport, Texas	Marine fisheries	C

Cooke County Junior College Gainesville, Texas	(Technicians)	P-71
Del Mar College Corpus Christi, Texas	Marine science electronics technology	C
El Centro College Dallas, Texas	Environmental technology	P-3
McLennan Community College Waco, Texas	Health and safety technology	C
Odessa College Odessa, Texas	Environmental health technology	C
St. Phillip's College San Antonio, Texas	Environmental technology	P-3
Tarrant County Junior College Fort Worth, Texas	Environmental technology Radiologic technology (Technicians)	C C P-3
Texas State Technical Institute Waco, Texas	Water and wastewater technology Air pollution control technology	C C
Wharton County Junior College Wharton, Texas	Pollution control technology	P-71

UTAH

Dixie College St. George, Utah	Wildlife management technology	P-71
Utah Technical College at Provo Provo, Utah	Pollution control technology	P-71

VIRGINIA

Danville Community College Danville, Virginia	Environmental technology	W
Northern Virginia Community College Annandale, Virginia	Environmental technology	W
Thomas Nelson Community College Hampton, Virginia	Environmental technology	P-3
Tidewater Community College Portsmouth, Virginia	Marine biology and oceanography	P-3
University of Virginia Wallops Island, Virginia	Environmental technology	W
Wytheville Community College Wytheville, Virginia	Environmental technology	C

WASHINGTON

Bellevue Community College Bellevue, Washington	Marine biology Marine technicians Environmental technology	P-3 P-3 P-3

Centralia College Centralia, Washington	Water and wastewater technology	P-3
Clark College Vancouver, Washington	(Technicians)	W
Columbia Basin College Pasco, Washington	Water and wastewater technology	W
Grays Harbor College Aberdeen, Washington	Conservation technicians	C
Green River Community College Auburn, Washington	Wastewater technology	C
Highline Community College Midway, Washington	Underseas technology	C
Lower Columbia College Longview, Washington	Oceanography	P-3
Peninsula College Port Angeles, Washington	Fisheries technology	C
Seattle Central Community College Seattle, Washington	Environmental technology	P-3
Shoreline Community College Seattle, Washington	Marine biology technology Oceanographic technology Pollution control technology	C P-3 C
Spokane Community College Spokane, Washington	Environmental technicians	P-72
Yakima Valley College Yakima, Washington	Environmental engineering technology	C

WEST VIRGINIA

Bluefield State College Bluefield, West Virginia	Environmental health technology	C
Potomac State College Keyser, West Virginia	Environmental technology (no degree)	C

WISCONSIN

Kenosha Technical Institute Kenosha, Wisconsin	Water and wastewater technology	C
Milwaukee Area Technical College Milwaukee, Wisconsin	Environmental health technology Water and wastewater technology	C C
University of Wisconsin Manitowoc County Campus Manitowoc, Wisconsin	(Technicians)	W

WYOMING

Eastern Wyoming College Torrington, Wyoming	Environmental health technology Environmental technology	C P-3
Laramie County Community College Cheyenne, Wyoming	Environmental health technology	C

Western Wyoming Community College Rock Springs, Wyoming	(Technicians)	P-72
CANADA		
Malaspina College Nanaimo, B.C.	Geologic technology Natural resource management	C C
Mount Royal College Calgary, Alberta	Natural resource management	P-3
Saskatoon Technical Institute Saskatoon, Saskatchewan	Renewable resources technology	C
Seneca College Willowdale, Ontario	Water and wastewater technology (no degree)	C
PUERTO RICO		
Inter-American University Arecibo Regional College Arecibo, Puerto Rico	(Technicians)	P-72
Inter-American University Bayamon Regional College Bayamon, Puerto Rico	(Technicians)	W
Puerto Rico Junior College Rio Piedras, Puerto Rico	(Technicians)	P-72
University of Puerto Rico Humacao Regional College Humacao, Puerto Rico	(Technicians)	P-3

Appendix 2

The Modules of Man and Environment

A brief description of each module included in the course described by Dr. McCabe follows:

ECOLOGICAL IMPERATIVES

This module attempts to convey (1) a clear understanding that man is an inseparable part of a system composed of men, culture, and the natural environment, and that man's technology alters the interrelationships of this system; (2) an appreciation of the environment, both natural and man-made; (3) a fundamental knowledge of the problems confronting man, ways to solve these problems, and the need for civic and governmental partnership in developing solutions; and (4) attitudes, ethical standards, and behavioral patterns which foster citizen commitment to overcoming the environmental crisis and to improving the quality of life.

THE NATURES OF MAN

This module is intended to provide an understanding of the biological and behavioral natures of man. Since man is the ecologically dominant species, his attitudes and behavior toward the use of the environment are crucial.

VALUE SYSTEMS—ECOLOGICAL PRIORITIES

This module is designed to show that at the base of our present chaotic world situation there lies a deeper crisis—a value crisis. In order to involve our students in a study of ecological priorities, we must begin with an evaluation of the "present"; after highlighting pertinent examples, we can then search for historical antecedents, relating them to the present and, in turn, suggesting alternative paths toward an ecologically sound future.

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BELIEF SYSTEMS

This module shows that the consideration of man as the ecological dominant is common to many societies. The belief is predicated on the historical actions of man in his formation of institutions to deal with the environment. At this point in time, an adjustment in man's beliefs may be necessary in order for him to live within a harmonious ecosystem.

THE MYTHS OF TECHNOLOGY

This module presents a definition, discussion, examination, and analysis of myths of technology. It attempts to develop a questioning and an analytical attitude toward statements which are indeed "myths." The use of technology and myths in a positive way with regard to environmental problems is considered.

Economic growth increases material wealth, but has a growing number of unfortunate side effects—each individual tries to increase his own possessions within an increasingly crowded environment. Growth is as deeply entangled in our economic thinking as rain dancing is in other societies.

CONCEPTS OF CHANGE

This module is designed to demonstrate the inconsistency of the physical and the living environment. The student is expected to identify some types of change and to select one of these types for an in-depth comparative study of factors effecting change and the consequences to be expected.

EARTH AS AN ENERGY SYSTEM

This module deals with the earth as both an open and a closed energy system. The implications of the first and second laws of thermodynamics are examined as they relate to an ecosystem. The expenditure of the fossil fuels is examined along with the necessity for man to look for new energy sources. Pollution is examined as a consequence of an energy expenditure, and an examination of the wise use of available energy is undertaken.

ENVIRONMENTAL PERCEPTION

This module considers that humanity is composed of groups of individuals perceiving their environment in terms of historic-cultural input. This input is based on the state or stages of technological development at that point in time. The Stone Age Indians of most of North America at the time of European discovery perceived the land as a "happy" or "not-so-happy hunting ground." The modern technologically oriented national planner perceives the same continent as a vastly more complex closed energy system or ecosystem. Every stage in an increasingly complex technology causes earth materials to have a new value as natural resources. The frontier attitude of "me-first, last, and always" may not be a viable philosophy for further inhabitance of this "small spaceship" called Earth.

Within a modern technological culture, it is necessary for *all* inhabitants of such a culture to appreciate this "small spaceship" concept toward all resources and consumables needed for continued living on this earth.

CONSERVATION OF VITAL RESOURCES

This module examines the vital resources available to man. These may be categorized as either renewable or non-renewable. This represents a con-

tinuum rather than a dichotomy. If man is to survive as a species with a life style commensurate with today's standard of living, he must be aware of the resources essential to his existence. These resources may be living or non-living; renewable or non-renewable; regenerative or reusable. When making an intelligent decision regarding the conservation of a vital resource, man must be able to recognize the interrelationships of the vital resources in the terms mentioned above. In addition, he must also be aware of the many social, political, economic, and medical implications involved when he makes a decision of this kind.

POPULATION DYNAMICS

This module examines the history of human population growth. The world's population, which was approximately 3.5 billion in 1969, increases about 2 per cent every year. If it continues at this rate, the world population will double by the year 2000. Our present population increases 180,000 daily—or more than 65 million a year. Half of the population now living on earth has been born since the end of World War II (1945).

The magnitude of the problem arising from this unprecedented multiplication of the human species has stirred the concern of thinking people everywhere. The expansion in world populations, projected for the remainder of this century, is staggering. The impending disaster, foretold by these statistics, demands the immediate concern of the world's approximate 3.6 billion.

URBANIZATION: THE LIVING COMMUNITY

This module considers the nature of the urban crisis. Cities developed by man in response to his needs become resource magnets. Availability of hard goods, food, water supply, and security have further centralized populations.

The population magnet may create overcrowding, depletion of resources, waste and sewage management problems, proliferation of disease, and most important, the diminishing of the human spirit.

Various approaches to the urban crisis are presented and evaluated.

WATER—SUPPLY, DEMAND, AND POLLUTION

This module deals with water—supply, demand, and pollution. It is designed to bring into awareness the factors causing the problem; methods of defining the problem; the scope of the problem; and the means of alleviating the problem.

The module is structured so that instructor and students progress as follows: (1) problem identification; (2) presentation of basic information relevant to the problem; (3) establishment of a student commitment to the solving of the particular problem; (4) appropriate student involvement translating concern into action.

AIR POLLUTION

This module considers the increasing amount of air pollution throughout the world and attempts to provide insight into the biological role of normal atmospheric components.

The acute effects of urban air pollution are well documented by extensive studies of air pollution disasters; the intermittent and sub-threshold effects

await further evidence. However, air pollution control should be immediately pressed and not await full elucidation of pollutant effects and mechanisms of action.

Community pollution control emanates from individual concern and individual action. The student is made aware of the necessity for his participation in the implementation of air pollution control.

FOOD AND DRUG POLLUTION

This module considers the accelerated abuses of food by the inclusion of additives, adulterants, preservatives, and pesticides.

Certain chemical additions are generally considered prerequisite to obtaining efficient crop yields and insuring proper preservation of our food. However, other chemical additions are strictly consumer-oriented; their inclusion in our foods is questionable at best, and may indeed constitute a real health hazard. Remedial measures will involve not only experimental identification of the toxic agents, but reconstruction of consumer attitudes with regard to the marketing and merchandising of his foods and drugs.

SOUND POLLUTION

This module examines the beneficial and harmful effects of sound. Man must become aware of the possible damage which can occur to his ears due to noise pollution. An investigation of the sources of noise should be attempted in order that appropriate courses of action can be formulated. A complete understanding of the problem will require a knowledge of the physical nature of sound and the anatomy and physiology of the human ear.

SCENIC POLLUTION

This module examines the growing changes in our scenic environment with emphasis on the distinctions between scenic modification and pollution as it affects man. The role of industries in scenic degradation and inefficient use of resources will be examined as will the social, psychological, economic, and political implications of scenic pollution.

INDIVIDUAL INVOLVEMENT

This module presents the student with guidelines by which he addresses himself to the problems of his environment. He learns ways to apply the knowledge acquired in the course in an effort to improve environmental conditions. An examination of involvement from the small matters of daily life to impact on major national decisions is presented.

WILDLIFE AND MAN

This module seeks to determine wildlife's place in the environment with respect to man. It is intended to show that wildlife is an integral part of man's environment, and that his activities affect the wildlife around him either negatively or positively. The module attempts to point out some of man's past errors, including the losses and disasters that have resulted from his ignorance, greed, or thoughtlessness.

An attempt is made to show how man can profit from his mistakes and strive to protect endangered species, regional and local wildlife populations, and the natural wildlife balances.

FORESTS AND MAN

This module attempts to point out the significance of forests as a major part of man's environment.

Man has been and is now greatly influenced by the various types of forests and he, in turn, has a profound effect on forest communities. This module attempts to point out both the positive and negative aspects of this effect.

Also examined in this module is the way man can use past experience to avoid mistakes in utilizing forest resources and how man can enhance the forest communities by careful scientific planning and implementation of sound forestry practices.

The wide scope of forest resources, products, and services is considered and the history of forestry practices is discussed.

While man may be in a more favorable position with respect to forest resources than he is with respect to other natural resources, constant diligence must be maintained to preserve a balance between man and his forest communities.

GRASSLANDS AND MAN

This module is built around the premise that the grassland areas of the United States (and the world) constitute a major part of the earth's environment.

Man has always been greatly influenced by the various types of natural grasslands and the cultivated farms which have replaced them. He, in turn, has had a profound effect on the grassland areas.

This module attempts to point out both the positive and negative aspects of man's conversion of natural grasslands to agriculture. Also considered are man's mistakes in utilizing grassland resources and their effects on soils, waters, and the American society.

SOIL AND MAN

This module seeks to show man's intimate dependence upon soil. Soils are examined in the urban, suburban, and rural environments. Soil types and resources are covered, as are the interrelationships within soil communities. Soil concerns are presented on the local, state, regional, national, and global level.

ROCK AND MINERAL RESOURCE MANAGEMENT

This module considers the rock and mineral resources in the environment. Rock and mineral resources are necessary to satisfy many of man's physical, biological, and cultural needs, and are of great significance in world affairs. Resource demands are increasing both in amount and variety, and have produced concomitant supply and environmental problems. These associated environmental problems occur at every stage of rock and mineral resource utilization. Consideration is given to the alternative measures available for problems of supply, and to methods of controlling the various environmental effects. The student should become aware of local rock and mineral resource utilization and involve himself in such local problems.

INDIVIDUAL MALADJUSTMENT

This module examines the nature of individual maladjustment in modern society. Various forms and causes of individual maladjustment are considered and effects on both the individual and society are examined.

The attempt is made to consider ways in which individual maladjustment may be either eliminated or diminished in the future, including a look at utopian societies.

INTERGROUP TENSIONS

This module examines intergroup tensions and the impact of these tensions on the quality of life. Intergroup tensions of various types are all about us. The causes and effects of these problems have, in turn, a profound effect on our society and our nation. It is essential that the causes of intergroup tension be understood and recognized by the students.

SOCIAL INSTITUTIONS

This module examines such social institutions as the family, the educational system, and special interest groups. These social institutions all serve as important agents in the transmission of attitudes, beliefs, values, and customs from one group and one generation to another. They serve as the agents for the socialization of the individual. The impact on the life style and, in turn, on the environment of social institutions, is profound.

IMPACT OF POLITICAL SYSTEMS

This module defines the function of political systems insofar as they pertain to man and environment.

All men live within a political system. Therefore, it is necessary to examine the parameters of the political systems and the common functions they perform. It then is necessary to examine and evaluate what different political systems have done to meet the challenges of specific environmental crises. A final objective of this module is to examine the response of the United States' political system to environmental problems and to suggest alternative methods of response.

IMPACT OF ECONOMIC SYSTEMS

This module examines the role that economic systems have in shaping man's perception of the environment. Economic systems influence the way men think about environmental problems and determine how they allocate resources. Because the economic policies of different nations are affecting the world's ecosystem, international bodies are currently attempting to promote an awareness of ecoproblems.

Appendix 3

Information Sources for Environmental Education

The organizations listed below have source materials available for E.E. either on a complimentary or charge basis. This list is certainly not all-inclusive. The specific listings are examples of the hundreds of institutions, groups, consortia, agencies, and projects which have a continuing interest in E.E.

Institute for Environmental Studies
University of Wisconsin
Madison, Wisconsin 53706

Department of Environmental Sciences
University of Virginia
Charlottesville, Virginia 22903

Department of Environmental
Industrial Health
University of Michigan
Ann Arbor, Michigan 48104

Intermediate Science Curriculum Study
Florida State University
Tallahassee, Florida 32304

Cooperative Science Education Center,
Inc.
156 Adams Lane
Oak Ridge, Tennessee 37830

National Audubon Society
1130 Fifth Avenue
New York, New York 10028

National Rifle Association of America
1600 Rhode Island Avenue, N.W.
Washington, D. C. 20036

National Tuberculosis and
Respiratory Disease Association
1740 Broadway
New York, New York 10019

National Wildlife Federation
1412 16th Street, N.W.
Washington, D. C. 20036

Izaak Walton League of America
1326 Waukegon Road
Glenview, Illinois 60025

Friends of Earth
917 15th Street, N.W.
Washington, D. C. 20005

National Sanitation Foundation
P.O. Box 1468
2355 West Stadium Blvd.
Ann Arbor, Michigan 48106

Social Science Education Consortium
970 Aurora
Boulder, Colorado 80302

Environmental Education Council
University of Wisconsin
Green Bay, Wisconsin 54302

Environmental Education Project
NEA Center
1201 16th Street, N.W.
Washington, D. C. 20036

International Environmental Institute
1225 19th Street, N.W.
Washington, D. C. 20036

Conservation Foundation
1717 Massachusetts Avenue, N.W.
Washington, D. C. 20036

School of Natural Resources
Ohio State University
Columbus, Ohio 43210

Research Learning Center
Clarion State College
Clarion, Pennsylvania 16214

Open Lands Project
53 West Jackson Boulevard
Chicago, Illinois 60604

American Association of
University Women
2410 Virginia Avenue, N.W.
Washington, D. C. 20006

American Chemical Society
1155 Sixteenth Street, N.W.
Washington, D. C. 20036

National Environmental Health
Association
Lincoln Building
1550 Lincoln Street
Denver, Colorado 80203

Earth Science Education Project
Box 1559
Boulder, Colorado 80302

Department of Environmental Sciences
Austin Peay State University
Clarksville, Tennessee 37040

School of Natural Resources
University of Michigan
Ann Arbor, Michigan 48104

Man and Environment Project
Miami-Dade Junior College
11011 S.W. 104th Street
Miami, Florida 33156

American Association of
Junior Colleges
One Dupont Circle, N.W.
Washington, D. C. 20036

Northwest Environmental Education
Center
Western Washington State College
Bellingham, Washington 98225

Office of Biological Education
American Institute of Biological
Sciences
Washington, D. C. 20016

Ecology Action Education Institute
Box 3895
Modesto, California 95352

The Group for Environmental
Education
1214 Arch Street
Philadelphia, Pennsylvania 19107

Center for the Study of the Physical
Environment
Institute of Technology
University of Minnesota
Minneapolis, Minnesota 55455

School of Public Health
600 West 168th Street
New York, New York 10032

Project SPREAD
Box 423
Norwalk, Connecticut 06856

Population Council
245 Park Avenue
New York, New York 10017

National Science Foundation
1800 G Street, N.W.
Washington, D. C. 20006

National Aeronautics and Space
Administration
400 Maryland Avenue, S.W.
Washington, D. C. 20202

Department of Interior
Washington, D. C. 20242

National Park Service
Washington, D. C. 20242

American Association for the
Advancement of Science
1515 Massachusetts Avenue, N.W.
Washington, D. C. 20005

Atomic Energy Commission
Washington, D. C. 20545

National Academy of Sciences
2101 Constitution Avenue, N.W.
Washington, D. C. 20037

American Institute of Architects
1785 Massachusetts Avenue, N.W.
Washington, D. C. 20036

Bureau of Land Management
Washington, D. C. 20250

Department of Commerce
Washington, D. C. 20230

Environmental Protection Agency
1129 20th Street, N.W.
Washington, D. C. 20036

Smithsonian Institution
Office of Environmental Sciences
Washington, D. C.

New York State Department of
Environment and Conservation
Albany, New York 12224

Department of the Navy
Pentagon
Washington, D. C. 20350

Bureau of Outdoor Recreation
Washington, D. C. 20240

New York State Commission on Youth
Education in Conservation
616 Pleasant Lane
Endwell, New York 13760

Department of Agriculture
Forest Service
Washington, D. C. 20250

American Geological Institute
2201 M Street, N.W.
Washington, D. C. 20037

American Industrial Arts Association
1201 Sixteenth Street, N.W.
Washington, D. C. 20036

American Society for Engineering
Education
One Dupont Circle, N.W.
Washington, D. C. 20036

Association of Classroom Teachers
National Education Association
1201 Sixteenth Street, N.W.
Washington, D. C. 20036

Biological Sciences Curriculum Study
University of Colorado
P.O. Box 930
Boulder, Colorado 80302

Committee on Environmental
Information
138 N. Skinker Boulevard
St. Louis, Missouri 63130

Council on Education in the
Geological Sciences
2201 M Street, N.W.
Washington, D. C. 20036

Council of State Governments
1735 DeSales Street, N.W.
Washington, D. C. 20036

ERIC Information Analysis Center for
Science and Mathematics Education
1460 West Lane Avenue
Columbus, Ohio 43221

National Association of Biology
Teachers
1420 N Street, N.W.
Washington, D. C. 20005

National Council for Social Studies
1201 Sixteenth Street, N.W.
Washington, D. C. 20036

National Education Association
1201 Sixteenth Street, N.W.
Washington, D. C. 20036

National Association of Environmental
Education
11011 S.W. 104th Street
Miami, Florida 33156